2006 Building Code Technical Training Courses

Building Services - 2006

Updated to July 1, 2011, Includes O. Reg. 315/11
Participant's Manual

This course material may assist you in preparing for writing the Ministry exams however it is strongly suggested that you also refer to the Qualification and Registration pages on the Building Code website (www.ontario.ca/buildingcode) for detailed examination syllabi, as well as reading and reviewing the Code.

Building and Development Branch
Ministry of Municipal Affairs & Housing

Ontario

Ontario

Ministry of Municipal Affairs and Housing

BUILDING SERVICES COURSE
2006

As updated to July 1, 2011 changes

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ANSWER KEY

Ontario

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BUILDING SERVICES
PARTICIPANT'S MODULE #1

The OBC and Building Services – Definitions and Scope

INTRODUCTION

In this module we will establish the scope of the course and introduce the concepts of building services and review fundamental definitions and navigation within the Ontario Building Code (OBC).

OBJECTIVES

Upon completion of this module participants will be able to:

- Apply strengthened OBC navigation skills;
- Distinguish scope of course contents;
- Describe and apply definitions and terms;
- Understand the concept of "applicable edition" of reference standards.

STOP

OBC NAVIGATION

The objective of this course is to help you understand the requirements of the Ontario Building Code (OBC) applicable to the area of Building Services. This includes requirements contained in Division B, Parts 1, 3, 6, 9, 11 and 12.

The Ministry of Municipal Affairs and housing's exam syllabus for Building Services is found on their website:

http://www.ontario.ca/buildingcode

under the headings: Qualification & Registration / Examination Syllabi.

Questions on the Ministry's exams are all multiple choice. They have been chosen to address OBC requirements based on the "Difficulty", "Importance" and "Frequency" of the requirement. Each question attempts to test the ability of the candidate to FIND, UNDERSTAND or APPLY the Code requirements.

LEARNING OUTCOMES

The course has been designed to introduce or increase (where applicable) a practitioner's knowledge of the OBC and to hone skills in terms of their ability to **FIND** (search the Code and identify non-familiar Code provisions), **UNDERSTAND** (to comprehend the language, structure and intent of a Code provision), and **APPLY** the Code provision(s) using case examples, situations and scenarios.

The Ministry of Municipal Affairs also provides more comprehensive courses for practitioners wishing to obtain more detailed training in the use and application of the OBC and a number of its referenced standards.

For information on the available courses, refer to the following website:

http://www.ontario.ca/buildingcode

under the heading "Training".

COURSE FORMAT

This course is organized in eighteen modules and is intended for those who desire to become more proficient in applying the provisions of the requirements applicable to Building Services.

PURPOSE OF THE EXERCISES

Every module contains a number of exercises. Each exercise is designed to help you to identify, understand and apply the requirements of the OBC and their effect on the design and construction of Building Services systems. The exercises are fill-in-the-blanks.

You will also be required to indicate the OBC reference for your answer. Pay attention to the detail of the reference. Any time a Code reference is asked for, it will be identified by "OBC Reference ______________________________"

As you go along, you are encouraged to modify and enhance your copy of the OBC.

When reference is made to specific parts of the Building Code at the beginning of an exercise, you may find it useful to review those references before attempting the exercise.

COURSE RESOURCES

Your participation, with support from the Facilitator, the OBC, and the experiences, ideas, and comments of your fellow students are the primary resources of this course. The objective of the course integrates your education, prior training and on-the-job experience, as well as those of your peers. It is important that you participate. For each question or task that is assigned to your table-group, you will select a spokesperson who will print the agreed upon answer on the flipchart. When asked by the Facilitator, the spokesperson will explain the group's answer, which forms the basis for class discussion.

The course only requires the latest edition of the 1997 Ontario Building Code, which is available for purchase through:

Service Ontario
Publications Ontario
(416)-325-5300
www.publications.gov.on.ca

A GUIDE TO THE USE OF THE OBC

The Ontario Building Code is a regulation made under the Building Code Act. This edition is prepared for purposes of convenience only and contains additional explanatory material. For accurate reference, recourse should be had to the Official Volumes.

The Ontario Building Code is based, in large measure, on the National Building Code of Canada (NBC).

The Code is essentially a set of minimum provisions respecting the safety of buildings with reference to public health, fire protection and structural sufficiency. It is not intended to be a textbook on building design, advice on which should be sought from professional sources. Its primary purpose is the promotion of public safety through the application of appropriate uniform building standards.

The Code is divided into 12 Parts and a decimal numbering system has been used to identify particular requirements. The first number indicates the Part of the Code, the second, the Section in the Part, the third, the Subsection and the fourth, the Article in the Subsection. An Article may be further broken down into Sentences (indicated by numbers in brackets), and the Sentence further divided into Clauses and Subclauses: These are illustrated as follows:

B	Division
3	Part
3.4.	Section
3.4.6.	Subsection
3.4.6.5.	Article
3.4.6.5.(1)	Sentence
3.4.6.5.(1)(c)	Clause
3.4.6.5.(1)(c)(i)	Subclause

The Objective-Based Code

The 2006 Ontario Building Code is published in an "objective-based" format. Each technical requirement that is an acceptable solution in Division B is linked to one or more objectives, as well as functional statements. The objective-based code establishes a framework for evaluating "alternative solutions" against the performance achieved by "acceptable solutions" set out in the Code.

The organization of the 2006 Code is:

Division A Compliance, Objectives and Functional Statements

The new objectives and functional statements are in Division A. Definitions and the application of the Parts of the Code are here.

Division B Acceptable Solutions

This is where the technical requirements of the 1997 Code are located, with a similar Part structure.

Division C Administrative Provisions

This Division deals with permits, inspections and qualifications.

Remember that the full reference for Part 6 (Heating, Ventilating and Air-Conditioning) is "Division B, Part 6". For the purposes of this course, Division B is implied unless otherwise stated. When "OBC" is used in this course it refers to the Ontario Building Code.

BASIC RULES FROM THE OBC

Defined Words, Terms and Phrases

Words, terms and phrases with special meaning are defined in Division A, Sentence 1.4.1.2.(1) of the OBC.

The definition always applies unless the word, term or phrase has a special purpose definition listed elsewhere.

Non-defined Words, Terms and Phrases

Consult Division A, Article 1.4.1.1. of the OBC. It provides direction for dealing with non-defined terms. Note any question, comment or concern in the space provided.

____

____

____

Abbreviations and Symbols

The OBC makes use of symbols and abbreviated nouns, terms and proper names. For example, Clause 3.2.6.9.(3)(a) makes reference to CAN4 and Clause 3.2.6.14.(4)(b) to ULC, both being abbreviated names of Underwriters' Laboratories of Canada. Article 1.1.4.1. of the OBC will reveal a number of abbreviations for proper names, along with contact information.

The meaning assigned to other 'Symbols and Abbreviations' used in the OBC are found in Sentence 1.1.4.2.(1). As examples, the letter 'h' means 'hour' in Sentence 9.10.9.11.(1) and 'hours' in Sentence 9.10.9.11.(2); the expression '1 in 2' means a slope of 1 vertical unit to 2 horizontal units.

BASIC RULES FOR READING THE OBC –SCOPE AND APPLICATION OF OBC REQUIREMENTS

Individual requirements within the OBC do not apply to every building. Guidance in the application of each of the 12 Parts of the OBC to a particular building is found in Division A, Subsection 1.1.2., "Buildings".

Dealing with "And"

The word '**and**' found at the end of the second last Clause of a Sentence with multiple Clauses means that the requirements of **every** Clause apply to the Sentence.

Example:

In the OBC, Sentence 3.2.8.7.(2) reads:

In a building containing an interconnected floor space

(a) waterflow alarm signals from sprinkler systems shall be transmitted to the fire department in conformance with Sentence 3.2.4.7.(4), and

(b) sprinkler systems shall be electrically supervised as required in Sentence 3.2.4.9.(2).

OBC Sentence 3.2.8.7.(2) informs us that in a building containing an interconnected floor space, the sprinkler systems shall have two things:

1. water flow alarm signals shall be transmitted to the fire department, AND
2. be electrically supervised.

Dealing with "Or"

The word '**or**' found at the end of the second last Clause of a Sentence with multiple Clauses means that the requirement of the Sentence is satisfied by any Clause as applied individually.

Example:

In the OBC, Sentence 3.2.9.4.(7) reads:

A hose is permitted to penetrate an exit in order to provide the required coverage to

(a) a service room referred to in Sentence 3.2.9.1.(4),
(b) a roof-top enclosure referred to in Sentence 3.2.9.1.(5),
(c) a room not more than 50 m^2 (538 ft^2) in area, or
(d) a room or group of rooms not more than 200 m^2 (2,150 ft^2) in area in a sprinklered floor area.

OBC Sentence 3.2.9.4.(7) informs us that a fire hose is permitted to penetrate an exit in order to provide the required coverage to any one of four areas:

1. a service room, **OR**
2. a rooftop enclosure, **OR**
3. a room less than 50 m^2 in area, **OR**
4. a sprinklered room or group of rooms less than 200 m^2 in area.

Dealing with "And/Or"

Some Sentences have both "and" and "or" in the clauses and subclauses. When reading these provisions first check the clause provisions – these should be linked by an "and" or "or" at the second-last clause. Then check the sub-clause provisions to be clear on how they are linked. It may help to remember that "and" means all the provisions apply, and the "or" means that there is a choice of any one. For an example of this, try analyzing Sentence 3.2.6.1.(1).

RULES OF THE OBC

The OBC is structured into a number of rules that apply without exception. For example, Sentence 9.1.1.3.(1) tells us that self-service storage buildings (even those with a building area of less than 600 m_2) are regulated by Section 3.10.

GENERAL RULES OF THE OBC AND EXCEPTIONS

At other times, the user of the OBC has to consider a general rule and exceptions as they apply. Consider the requirements for automatic sprinkler systems in Sentence 3.2.5.13.(1):

Except as provided in Sentences (2), (3) and (4), an automatic sprinkler system shall be designed, constructed, installed and tested in conformance with NFPA 13, "Standard for the Installation of Sprinkler Systems". The general rule of Sentence 3.2.5.13.(1) informs us that sprinkler systems are to be designed, constructed, installed and tested in conformance with NFPA 13

OR

There are three exceptions to the general rule of Sentence 3.2.5.13.(1). The first exception in Sentence 3.2.5.13.(2) states:

Instead of requirements of Sentence (1), NFPA 13R, "Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height", is permitted to be used for the design, construction, installation and testing of an automatic sprinkler system installed in a building of residential occupancy that is not more than 4 storeys in building height.

The second exception in Sentence 3.2.5.13.(3) states:

Instead of the requirements of Sentence (1), NFPA 13D, "Standard for the Installation of Sprinkler Systems in One and Two-Family Dwellings and Mobile Homes", is permitted to be used for the design, construction, installation and testing of an automatic sprinkler system installed in a building of residential occupancy that contains not more than 2 dwelling units.

The third exception in Sentence 3.2.5.13.(4) states:

If a building contains fewer than 9 sprinklers, the water supply for these sprinklers is permitted to be supplied from the domestic water system for the building provided the required flow for the sprinklers can be met by the domestic system.

VERY IMPORTANT

When the OBC spells out a general rule and exceptions thereto, conformity with the OBC is obtained by complying with EITHER the general rule OR the exception thereto.

TABLES TEXT AND FOOTNOTES

Whenever you are called upon to use a Table in the OBC, you have to **consider the text** associated with **the Table** AND **the footnotes**. For example, Table 3.1.3.1 forms part of Sentence 3.1.3.1.(1). One of the Notes to Table 3.1.3.1, Note (2) directs us to Sentence 3.1.3.2.(1), which tells us that any building with any Group A, B or C occupancy, cannot contain a major occupancy of Group F, Division 1.

SUPPLEMENTARY STANDARDS AND REFERENCED DOCUMENTS

The Supplementary Standards, published as Volume 2 of the 2006 Building Code Compendium form an integral part of the 2006 Ontario Building Code.

The Supplementary Standards are referenced from within the OBC.

The OBC references numerous documents published by various agencies that have established standards of quality and safety such as CSA, NFPA, ULC, and many others. There are three important things to note about referenced documents: their applicable edition, the extent to which they apply, and what to do if there are conflicting requirements.

It is important to note that the OBC applicable edition of a document is as specifically declared in Division B Part 1 of the OBC and may not be the latest edition of the document available from the issuing agency.

It is also important to note the **extent to which a referenced document applies**, as stated in Division A, Sentence 1.5.1.1.(1):

The provisions of a referenced document in Divisions A and B apply only to the extent that the provisions relate to,

(a) buildings, and

(b) the *objectives and functional statements* attributed to the applicable *acceptable solutions* in Division B where the document is referenced.

To illustrate this, use the fictional example that a certain standard may be referenced for installation requirements of ducts. If the reference standard included provisions for the colour of such ducts, but the OBC did not have an objective or functional statement linked to duct installation that deals with colour, the colour requirements from the standard would not be applicable.

If there are conflicting requirements between the Code and a referenced standard, Division A, Article 1.5.1.2. states that the Code shall govern.

APPENDICES AND ILLUSTRATED GUIDES

The Appendices including Appendix A "Explanatory Material for the Ontario Building Code 1997", and Appendix B "Imperial Conversions of Metric Values" and the "Illustrated Guide to the Ontario Building Code 1997" have been prepared for convenience only, and as such, are explanations that do not form part of the Ontario Building Code and are not intended to limit the ways by which compliance with OBC requirements can be achieved.

SCOPE OF BUILDING SERVICES IN THE OBC

Division B, Part 3 Fire Protection, Occupant Safety and Accessibility and Part 6 Heating, Ventilating and Air-Conditioning, apply to all *buildings* occupying an area greater than ten square meters and used for;

- Group A, assembly occupancies,
- Group B, care or detention occupancies, or
- Group F, Division 1, high hazard industrial occupancies

The OBC Part 3 and Part 6 also apply to all *buildings* occupying an area exceeding 600 m^2 in *building area* or exceeding 3 *storeys* in *building height* used for *major occupancies* classified as;

- Group C, residential occupancies,
- Group D, business and personal services occupancies,
- Group E, mercantile occupancies, or
- Group F, Division 2 and 3, medium and low hazard industrial occupancies.

The exceptions to the above include

- *farm buildings* (covered by National Farm Building Code) see Division A Article 1.3.1.2.,
- existing *buildings* (older than five years) by Division B, Part 11
- designated structures as defined in OBC 1.3.1.1 of Division A.

Division B, Part 9 Housing and Small Buildings, applies to *buildings* occupying an area greater than ten square metres, of 3 *storeys* or less in *building height*, having a *building area* not exceeding 600 m^2, and used for

- Group C, residential occupancies,
- Group D, business and personal services occupancies,
- Group E, mercantile occupancies, or
- Group F, Division 2 and 3, medium and low hazard industrial occupancies.

The exceptions to the above include

- a manufactured *building* intended for *residential occupancy* that complies with standards and requirements recognized and described in the Division B, 9.1.1.9
- *farm buildings* (covered by National Farm Building Code)
- existing *buildings* (older than five years) by OBC Part 11

BUILDING SERVICES: COURSE INTRODUCTION

This course covers the requirements of the OBC as applied to building services in all types of buildings. Requirements for building services in the OBC have been identified to have an impact on the following;

- energy efficiency,
- *combustible* and *noncombustible construction,*
- *fire dampers,*
- *fire separations* and fire rated assemblies,
- *building* fire safety,
- safety within floor areas,
- *exits,*
- service facilities,
- health requirements,
- barrier-free design, and
- heating, ventilating and air-conditioning.

ENERGY EFFICIENCY BEFORE JANUARY 1, 2012

As per Division B, Article 12.2.1.1., the energy efficiency of all *buildings* is to be designed to good engineering practice as described in

- the ANSI/ASHRAE/IESNA 90.1-2004, "Energy Standard for Buildings Except Low-Rise Residential Buildings" and Supplementary Standard SB-10 (July1, 2011 Update), or
- the Model National Energy Code for Buildings, 1997 and Supplementary Standard SB-10 (July1, 2011 Update).

The exceptions to the above include

- *buildings* of *residential occupancy* (within OBC Part 9)
- *farm buildings*, and
- areas of *buildings* intended primarily for manufacturing or commercial or industrial processing

ENERGY EFFICIENCY AFTER DECEMBER 31, 2011

As per Article 12.2.1.2. of the Building Code, the energy efficiency of all *buildings* shall conform to Supplementary Standard SB-10 (July 1, 2011 Update).

The exceptions to the above include

- *buildings* of *residential occupancy* (within OBC Part 9)
- *farm buildings*, and
- *buildings intended primarily for manufacturing or commercial or industrial processing*

Supplementary Standard SB-12 includes prescriptive requirements for energy efficiency for a building or part of a building of residential occupancy that is within the scope of Part 9 and is intended for occupancy on a continuing basis during the winter.

EXISTING BUILDINGS AND BUILDING SYSTEMS

The following scope issues are covered in the Division B, Part 11 (Module 18)

- New and Existing Building Systems
- Material Alteration or Repair of a Building System
- New Building Systems and Extension of Existing Building Systems
- Extension of Buildings
- Portion of Extended Buildings

STOP

EXAMPLE QUESTION

- Describe the search process for finding the OBC reference to CAN/ULC-S109, "Flame Tests of Flame-Resistant Fabrics and Films" with regard to *combustible* fabric vibration isolation connectors in air duct systems?

Answer: ____

____

OBC Reference ______________________________________

EXERCISE #1-1

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. Which one of the following *buildings* of 500 m^2 *building area* and 3 *storeys* in *building height* is governed by OBC Part 3 Fire Protection Occupant Safety and Accessibility, and Part 6 Heating, Ventilating and Air-Conditioning and used for?
    a) Group E, *mercantile occupancy;*
    b) Group D, *business and personal services occupancy;*
    c) Group F, Division 2 and 3, *medium and low hazard industrial occupancy;*
    d) Group F, Division 1, *high hazard industrial occupancy.*

OBC Reference ______________________________

2. Describe the search process for finding the OBC applicable edition of CAN/ULC- S112, "Fire Test of Fire-Damper Assemblies"?

Answer: ______________________________

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____

____

OBC Reference ______________________________

3. Which one of the following buildings is required to be designed to conform to ANSI/ASHRAE/IESNA 90.1-2004?
   - a) A 600 m^2 *building area* mushroom growing facility;
   - b) A 50 m^2 *building area* retail store;
   - c) A 500 m^2 *building area* luxury bungalow;
   - d) A 50 m^2 *building area* metal foundry.

OBC Reference ______________________________

4. A question refers to *building* services passing through a *fire separation* that separates an *exit* from the remainder of a *building*. Describe the search process for finding the OBC reference that contains the compliance requirement?

Answer: ____________________________________

____

____

OBC Reference ______________________________

STOP

DEFINITIONS OF WORDS AND PHRASES

Lists of definitions of words and phrases are included in Division A, Part 1 of the OBC. Definitions of words and phrases used in the OBC that are not included in the list of definitions in the OBC have meanings which are commonly assigned to them in the various trades and professions to which the terminology applies. Defined words or phrases used in the OBC are indicated by the use of italics and have the following meaning for the purposes of the OBC. The first half (A to L) of the list has been edited for terms most commonly found within the scope of this course.

Acceptable solution means a requirement stated in Parts 3 to 12.

Access to exit means that part of a *means of egress* within a *floor area* that provides access to an *exit* serving the *floor area*.

Air barrier system means an assembly installed to provide a continuous barrier to the movement of air.

Air-conditioning is the process of treating air in a space to control simultaneously its temperature, humidity, cleanliness, and distribution to meet the comfort requirements of the occupants of the space.

Air-supported structure means a structure consisting of a pliable membrane that achieves and maintains its shape and support by internal air pressure.

Alarm signal means an audible signal transmitted throughout one or more zones of a building or throughout a *building* to advise occupants that a fire emergency exists.

Alert signal means an audible signal to advise designated persons of a fire emergency.

Alternative solution means a substitute for an acceptable solution.

Appliance means a device to convert fuel into energy and includes all components, controls, wiring and piping required to be part of the device by the applicable standard referred to in this Code.

Architect means, for the purposes of the Act and this Code, the holder of a licence, a certificate of practice or a temporary licence under the *Architects Act*.

As constructed plans means, for the purposes of the Act and this Code, *construction* plans and specifications that show the *building* and the location of the *building* on the property as the *building* has been constructed.

Assembly occupancy means the *occupancy* or the use of a *building* or part of a building by a gathering of persons for civic, political, travel, religious social, educational, recreational or similar purposes, or for the consumption of food or drink.

Attic or roof space means the space between the roof and the ceiling of the top *storey* or between a dwarf wall and a sloping roof.

Backflow means a flowing back or reversal of the normal direction of the flow.

Backflow preventer means a device or a method that prevents backflow in a water distribution system.

Back-siphonage means *backflow* caused by a negative pressure in the supply system.

Back-siphonage preventer means a device or a method that prevents back-siphonage in a water distribution system.

Barrier-free means, when applied to a *building* and its facilities, that the *building* and its facilities can be approached, entered, and used by persons with physical or sensory disabilities.

Basement means one or more *storeys* of a *building* located below the *first storey*.

Boarding, lodging or rooming house means a building,

(a) that has a *building height* not exceeding 3 *storeys* and a *building area* not exceeding 600 m^2 ,

(b) in which lodging is provided for more than 4 persons in return for remuneration or for the provision of services or for both, and

(c) in which the lodging rooms do not have both bathrooms and kitchen facilities for the exclusive use of individual occupants.

Boiler means an *appliance* intended to supply hot water or steam for space heating, processing or power purposes.

Breeching means a *flue pipe* or chamber for receiving *flue* gases from 1 or more *flue* connections and for discharging these gases through a single *flue* connection.

Building area means the greatest horizontal area of a *building* above *grade*,

(a) within the outside surface of exterior walls, or

(b) within the outside surface of exterior walls and the centre line of *firewalls*.

Building Code website means the website at www.obc.mah.gov.on.ca.

Building control valve means the valve on a water system that controls the flow of potable water from the water service pipe to the water distribution system.

Building height means the number of *storeys* contained between the roof and the floor of the *first storey*.

Business and personal services occupancy means the *occupancy* or use of a *building* or part thereof for the transaction of business or the rendering or receiving of professional or personal services.

Camp for housing of workers means a camp in which *buildings* or other structures or premises are used to accommodate 5 or more employees.

Care and treatment occupancy (Group B, Division 2) means an *occupancy* in which persons receive special care and treatment.

Care occupancy (Group B, Division 3) means an *occupancy* in which persons receive special or supervisory care because of cognitive or physical limitations, but does not include a *dwelling unit*.

Care or detention occupancy means the *occupancy* or use of a *building* or part of a building by persons who,

(a) are dependent on others to release security devices to permit egress,

(b) receive special care and treatment, or

(c) receive supervisory care.

Cavity wall means a construction of masonry units laid with a cavity between the wythes, where the wythes are tied together with metal ties or bonding units and are relied on to act together in resisting lateral loads.

Chimney means a shaft that is primarily vertical and that encloses at least 1 *flue* for conducting *flue* gases to the outdoors.

Chimney liner means a conduit containing a *chimney flue* used as a lining of a *masonry or concrete chimney*.

Closure means a device or assembly for closing an opening through a *fire separation* or an exterior wall, such as a door, a shutter, wired glass and glass block, and includes all components such as hardware, closing devices, frames and anchors.

Combustible means that a material fails to meet the acceptance criteria of CAN4-S114, "Standard Method of Test for Determination of Non-Combustibility in Building Materials."

Combustible construction means a type of construction that does not meet the requirements for *noncombustible construction*.

Compliance alternative means a substitute for a requirement in another Part that is listed in Part 10 or 11, and "C.A." has a corresponding meaning.

Computer room means a room,

(a) that contains electronic computer or data processing equipment such as main frame type,

(b) that is separated from the remainder of the *building* for the purpose of controlling the air quality in the room by a self-contained climate control system, and

(c) that has an *occupant load* of not more than one person for each 40 m^2 of the room.

Conditioned space means space within a *building* in which the temperature is controlled to limit variation in response to the exterior ambient temperature or interior differential temperatures by the provision, either directly or indirectly, of heating or cooling over substantial portions of the year.

Contained use area means a supervised area containing one or more rooms in which occupant movement is restricted to a single room by security measures not under the control of the occupant.

Day camp means a camp or resort that admits persons for a continuous period not exceeding twenty-four hours.

Day nursery means a day nursery as defined in the *Day Nurseries Act*.

Design activities means the activities described in subsection 15.11 (5) of the Act.

Designer means the person responsible for the design.

Detention occupancy (Group B, Division 1) means an *occupancy* in which persons are under restraint or are incapable of self preservation because of security measures not under their control.

Developed length, when applied to a pipe and fittings, means the length along the centre line of the pipe and fittings.

Distributing pipe means a pipe or piping in a water distribution system.

Diving board means a flexible board.

Diving platform means a rigid platform that is not a *starting platform*.

Dwelling unit means a *suite* operated as a housekeeping unit, used or intended to be used as a domicile by 1 or more persons and usually containing cooking, eating, living, sleeping and sanitary facilities.

Electric space heating means an electric energy source that provides more than 10% of the heating capacity provided for the *building* and includes the following types:

(a) electric resistance unitary baseboard heating,

(b) electric resistance unitary cabinet heating,

(c) electric resistance ceiling cable or floor cable heating,

(d) electric resistance central furnace heating,

(e) electric hot water space heating, or

(f) air source heat pumps in combination with electric resistance backup heating.

Exhaust duct means a duct through which air is conveyed from a room or space to the outdoors.

Exit means that part of a *means of egress*, including doorways, that leads from the *floor area* it serves, to a separate *building*, an open public thoroughfare, or an exterior open space protected from fire exposure from the *building* and having access to an open public thoroughfare.

Exit level means the level of an *exit* stairway in a *building* at which an exterior *exit* door or *exit* passageway leads to the exterior.

Exit storey means a *storey* having an exterior *exit* door in a *building* governed by Subsection 3.2.6.

Exposing building face means that part of the exterior wall of a *building* which faces one direction and is located between ground level and the ceiling of its top *storey*, or where a *building* is divided into *fire compartments*, the exterior wall of a *fire compartment* which faces one direction.

Exterior cladding means those components of a *building* which are exposed to the outdoor environment and are intended to provide protection against wind, water or vapour.

Factory-built chimney means a *chimney* consisting entirely of factory-made parts, each designed to be assembled with the other without requiring fabrication on site.

Farm building means all or part of a *building*,

(a) that does not contain any area used for *residential occupancy*,

(b) that is associated with and located on land devoted to the practice of farming, and

(c) that is used essentially for the housing of equipment or livestock or the production, storage or processing of agricultural and horticultural produce or feeds.

Fire compartment means an enclosed space in a *building*,

(a) that is separated from all other parts of the *building* by enclosing construction that provides a *fire separation*, and

(b) that may be required to have a *fire-resistance rating*.

Fire damper means a *closure* that consists of a normally held open damper installed in an air distribution system or in a wall or floor assembly and designed to close automatically in the event of a fire in order to maintain the integrity of the *fire separation*.

Fire detector means a device that detects a fire condition and automatically initiates an electrical signal to actuate an *alert signal* or *alarm signal* and includes *heat detectors* and *smoke detectors*.

Fire-protection rating means the time in minutes or hours that a *closure* will withstand the passage of flame when exposed to fire under specified conditions of test and performance criteria, or as otherwise prescribed in this Code.

Fire-resistance rating means the time in minutes or hours that a material or assembly of materials will withstand the passage of flame and the transmission of heat when exposed to fire under specified conditions of test and performance criteria, or as determined by extension or interpretation of information derived from that test and performance as prescribed in this Code.

Fire separation means a construction assembly that acts as a barrier against the spread of fire.

Fire service main means a pipe and its appurtenances that are connected to a source of water and that are located on the property:

(a) between the source of water and the base of the riser of a water-based fire protection system,

(b) between the source of water and inlets to foam making systems,

(c) between the source of water and the base elbow of private hydrants or monitor nozzles,

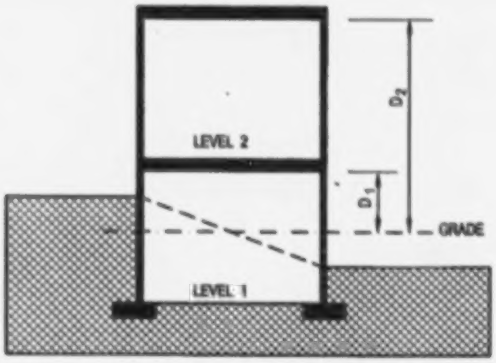
(d) as fire pump suction and discharge piping not within a *building*, or

(e) beginning at the inlet side of the check valve on a gravity or pressure tank.

Fire stop flap means a device intended for use in horizontal assemblies required to have a *fire-resistance rating* that incorporates protective ceiling membranes and that operates to close off a duct opening through the membrane in the event of a fire.

Firewall means a type of *fire separation* of *noncombustible construction* that subdivides a *building* or separates adjoining *buildings* to resist the spread of fire and that has a *fire-resistance rating* as prescribed in this Code and the structural stability to remain intact under fire conditions for the required fire-rated time.

First storey means the *storey* that has its floor closest to *grade* and having its ceiling more than 1.8 m above *grade*.



LEVEL 1 IS THE FIRST STOREY IF DISTANCE D$_1$ IS MORE THAN 1 800 mm.
LEVEL 2 IS THE FIRST STOREY IF DISTANCE D$_1$ IS LESS THAN 1 800 mm AND D$_2$ IS GREATER THAN 1 800mm.

FIGURE 1-1

Flame-spread rating means an index or classification indicating the extent of the spread –of flame on the surface of a material or an assembly of materials, as determined in a standard fire test as prescribed in this Code.

Floor area means the space on any *storey* of a *building* between exterior walls and required *firewalls* including the space occupied by interior walls and *partitions*, but not including *exits*, *vertical service spaces*, and their enclosing assemblies.

Flue means an enclosed passageway for conveying *flue* gases.

Flue collar means the portion of a fuel-fired *appliance* designed for the attachment of the *flue pipe* or *breeching*.

Flue pipe means the pipe connecting the *flue collar* of an *appliance* to a *chimney*.

Forced-air furnace means a *furnace* equipped with a fan that provides the primary means for the circulation of air.

Fresh air inlet means a *vent pipe* that is installed in conjunction with a *building trap* and terminates in *open air*.

Furnace means a *space-heating appliance* using warm air as the heating medium and usually provides for the attachment of ducts.

Gaming premises means gaming premises as defined in the Ontario Lottery and Gaming Corporation Act, 1999.

Gas vent means that portion of a venting system designed to convey vent gases to the outdoors,

(a) from the *vent connector* of a gas-fired *appliance*, or

(b) directly from the *appliance* when a *vent connector* is not used.

Grade means the average level of proposed or finished ground adjoining a *building* at all exterior walls.

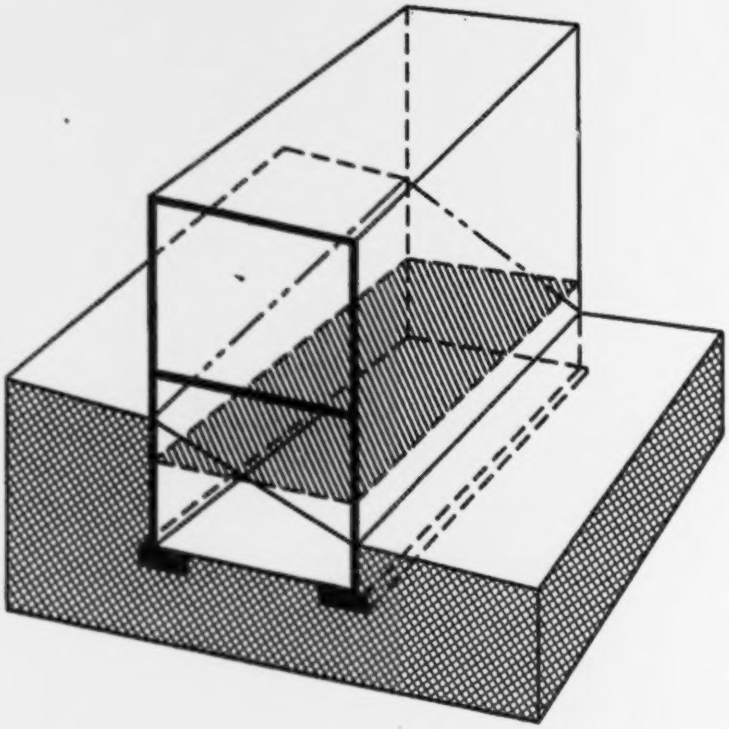


FIGURE 1-2

Gross area means the total area of all floors above *grade* measured between the outside surfaces of exterior walls or between the outside surfaces of exterior walls and the centre line of *firewalls* except that, in any other *occupancy* than a *residential occupancy*, where an access or a *building* service penetrates a *firewall*, measurements shall not be taken to the centre line of such *firewall*.

Hazardous classroom means a classroom,

(a) that is supplied with flammable gas,

(b) that contains hazardous substances such as chemicals or explosive dusts,

(c) that contains large quantities of *combustible* materials, or

(d) where cooking equipment is used.

Hazardous room means a room containing sufficient quantities of a substance that, because of its chemical nature, may create an atmosphere or condition of imminent hazard to health.

Heat detector means a *fire detector* designed to operate at a predetermined temperature or rate of temperature rise.

Heavy timber construction means that type of *combustible construction* in which a degree of fire safety is attained,

(a) by placing limitations on the sizes of wood structural members and on the thickness and composition of wood floors and roofs, and

(b) by the avoidance of concealed spaces under floors and roofs.

Heritage building means a building,

(a) that is designated under the *Ontario Heritage Act*, or

(b) that is certified to be of significant architectural or historical value by a recognized, non-profit public organization whose primary object is the preservation of structures of architectural or historical significance and which certification is accepted by the *chief building official*.

High hazard industrial occupancy (Group F, Division 1) means an *industrial occupancy* containing sufficient quantities of highly *combustible* and flammable or explosive materials to constitute a special fire hazard because of their inherent characteristics.

Home for special care means a home for the care of persons requiring nursing, residential or sheltered care.

Horizontal exit means an *exit* from one *building* to another by means of a doorway, vestibule, *walkway*, bridge or balcony.

Horizontal service space means a space such as an attic, duct, ceiling, roof or crawl space,

(a) that is oriented essentially in a horizontal plane,

(b) that is concealed and generally inaccessible, and

(c) through which *building* service facilities such as pipes, ducts and wiring may pass.

Hotel means *floor areas*, a *floor area* or part of a *floor area* that contains 4 or more *suites* and that provide sleeping accommodation for the travelling public or for recreational purposes.

Impeded egress zone means a supervised area in which occupants have free movement but require the release, by security personnel, of security doors at the boundary before being able to leave the area, but does not include a *contained use area*.

Indoor pool means a *public pool* where the pool and *pool deck* are totally or partially covered by a roof.

Industrial occupancy means the *occupancy* or use of a *building* or part of a building for the assembling, fabricating, manufacturing, processing, repairing or storing of goods and materials.

Interconnected floor space means superimposed *floor areas* or parts of *floor areas* in which floor assemblies that are required to be *fire separations* are penetrated by openings that are not provided with *closures*.

Limiting distance means the distance from an *exposing building face* to a property line, the centre line of a *street*, lane or public thoroughfare or to an imaginary line between 2 *buildings* or *fire compartments* on the same property, measured at right angles to the *exposing building face*.

Listed means equipment or materials included in a list published by a certification organization accredited by the Standards Council of Canada.

Low hazard industrial occupancy (Group F, Division 3) means an *industrial occupancy* in which the *combustible* content is not more than 50 kg/m^2 or 1200 MJ/m^2 of *floor area*.

Low human occupancy means, when applying to *farm buildings*, an *occupancy* in which the *occupant load* is not more than one person per 40 m^2 of *floor area* during normal use.

EXAMPLE QUESTION

Based on the OBC definition of *appliance,* which one of the following is NOT an *appliance*?

a) heating boiler;
b) dishwasher;
c) hot water tank;
d) furnace.

OBC Reference ____________________

EXERCISE #1-2

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. Based on the OBC definition of *electric space heating,* which one of the following heating methods is NOT *electric space heating?*
    a) electric resistance infrared lamp;
    b) electric resistance ceiling cable;
    c) electric hot water heating boiler;
    d) air source heat pump with back-up.

OBC Reference ______________________________

2. Based on the OBC definition of a *closure,* which one of the following is a *closure?*
    a) a *fire detector;*
    b) a *rated* door frame;
    c) glass block;
    d) a sprinkler head.

OBC Reference ______________________________

DEFINITIONS OF WORDS AND PHRASES

Lists of definitions of words and phrases are included in Part 1 of Division A of the OBC. Definitions of words and phrases used in the OBC that are not included in the list of definitions in the OBC have meanings which are commonly assigned to them in the various trades and professions to which the terminology applies. Defined words or phrases used in the OBC are indicated by the use of italics and have the following meaning for the purposes of the OBC. The second half (M to Z) of the list has been edited for terms most commonly found within the scope of this course.

Major occupancy means the principal *occupancy* for which a *building* or part of a building is used or intended to be used, and is deemed to include the subsidiary *occupancies* that are an integral part of the principal *occupancy*.

Means of egress includes *exits* and *access to exits* and means a continuous path of travel provided for the escape of persons from any point in a *building* or in a contained open space to,

(a) a separate *building*,

(b) an open public thoroughfare, or

(c) an exterior open space protected from fire exposure from the *building* and having access to an open public thoroughfare.

Medium hazard industrial occupancy (Group F, Division 2) means an *industrial occupancy* in which the *combustible* content is more than 50 kg/m^2 or 1200 MJ/m^2 of *floor area* and not classified as *high hazard industrial occupancy*.

Mercantile occupancy means the *occupancy* or use of a *building* or part of a building for the displaying or selling of retail goods, wares or merchandise.

Mezzanine means an intermediate floor assembly between the floor and ceiling of any room or *storey* and includes an interior balcony.

Nominally horizontal means at an angle of less than 45° with the horizontal.

Nominally vertical means at an angle of not more than 45° with the vertical.

Noncombustible means that a material meets the acceptance criteria of CAN4-S114, "Standard Method of Test for Determination of Non-Combustibility in Building Materials".

Noncombustible construction means a type of construction in which a degree of fire safety is attained by the use of *noncombustible* materials for structural members and other building assemblies.

Occupancy means the use or intended use of a *building* or part of a building for the shelter or support of persons, animals or property.

Occupant load means the number of persons for which *building* or part thereof is designed.

Open air means the atmosphere outside a *building*.

Open-air storey means a *storey* in which at least 25% of the total area of its perimeter walls is open to the outdoors in a manner that will provide cross ventilation to the entire *storey*.

Partition means an interior wall 1 *storey* or part-*storey* in height that is not *loadbearing*.

Party wall means a wall,

(a) that is jointly owned and jointly used by 2 parties under easement agreement or by right in law, and

(b) that is erected at or upon a line separating 2 parcels of land each of which is, or is capable of being, a separate real estate entity.

Performance level means that level of performance under which all or part of an existing *building* functions with respect to its *building systems*.

Plenum means a chamber forming part of an air duct system.

Pool deck means the area immediately surrounding a *public pool*.

Portable privy means a portable latrine in which the receptacle for human body waste and the superstructure are combined structurally into one unit.

Professional engineer means, for the purposes of the Act and this Code, a person who holds a licence or a temporary licence under the *Professional Engineers Act*.

Public corridor means a corridor that provides *access to exit* from more than 1 *suite*.

Public heritage building means a *heritage building* where the *occupancy* in whole or in part includes viewing of the building by the public provided that displays in it are limited to those relevant to the heritage significance of the *building*.

Public pool means a structure, basin, chamber or tank containing or intended to contain an artificial body of water for swimming, water sport, water recreation or entertainment but does not include,

(a) pools operated in conjunction with less than six *dwelling units*, *suites* or single family residences or any combination thereof,

(b) pools that are used only for commercial display and demonstration purposes,

(c) wading pools,

(d) hydro-massage pools, or

(e) pools that serve only as receiving basins for persons at the bottom of water slides.

Public spa means a hydro-massage pool containing an artificial body of water that is intended primarily for therapeutic or recreational use, that is not drained, cleaned or refilled before use by each individual and that utilizes hydrojet circulation, air induction bubbles, current flow or a combination of them over the majority of the pool area, but does not include,

(a) wading pools, or

(b) spas operated in conjunction with less than six *dwelling units*, *suites* or single family residences, or any combination of them, for the use of occupants or residents and their visitors.

Public use means, when applied to plumbing *fixtures*, *fixtures* in general washrooms of schools, gymnasiums, hotels, bars, public comfort stations and other installations in which *fixtures* are installed so that their use is unrestricted.

Public way means a sidewalk, *street*, highway, square or another open space to which the public has access, as of right or by invitation, expressed or implied.

Range means a cooking *appliance* equipped with a cooking surface and 1 or more ovens.

Recirculation system means a system,

(a) that maintains circulation of water through a *public pool* by pumps, and

(b) that provides continuous treatment of the water, including filtration and chlorination or bromination and any other process that may be necessary for the treatment of the water.

Repair garage means a *building* or part of a building where facilities are provided for the repair or servicing of motor vehicles.

Residential occupancy means the *occupancy* or use of a *building* or part of a building by persons for whom sleeping accommodation is provided but who are not harboured or detained there to receive medical care or treatment or who are not involuntarily detained there.

Return duct means a duct for conveying air from a space being heated, ventilated or air-conditioned back to the heating, ventilating or *air-conditioning appliance*.

Riser means a water *distributing pipe* that extends through at least one full *storey*, as defined in Part 7.

Self-service storage building means a *building* that is used to provide individual storage spaces to the public and that is open to the public only for those purposes.

Service room means a room provided in a *building* to contain equipment associated with *building* services.

Service space means space provided in a *building* to facilitate or conceal the installation of building service facilities such as chutes, ducts, pipes, shafts or wires.

Service water heater means a device for heating water for *plumbing* services.

Size means the nominal diameter by which a pipe, fitting, *trap* or other similar item is commercially designated.

Smoke alarm means a combined *smoke detector* and audible alarm device designed to sound an alarm within the room or *suite* in which it is located on the detection of smoke within that room or *suite*.

Smoke detector means a *fire detector* designed to operate when the concentration of airborne combustion products exceeds a pre-determined level.

Space heater means a *space-heating appliance* for heating the room or space within which it is located, without the use of ducts.

Space-heating appliance means an appliance,

(a) that is intended to supply heat directly to a room or space, such as a *space heater*, fireplace or *unit heater*, or

(b) that is intended to supply heat to rooms or spaces of a *building* through a heating system such as a central *furnace* or *boiler*.

Sprinklered means equipped with a system of automatic sprinklers.

Stage means a space designed primarily for theatrical performances with provision for quick change scenery and overhead lighting, including environmental control for a wide range of lighting and sound effects, and that is traditionally, but not necessarily, separated from the audience by a proscenium wall and curtain opening.

Storage garage means a *building* or part of a building intended for the storage or parking of motor vehicles and that contains no provision for the repair or servicing of such vehicles.

Storage-type service water heater means a service water heater with an integral hot water storage tank.

Storey means, except for the purposes of Part 7, the portion of a *building*,

(a) that is situated between the top of any floor and the top of the floor next above it, or

(b) that is situated between the top of the floor and the ceiling above the floor, if there is no floor above it.

Stove means an *appliance* intended for cooking or space heating or both.

Street means any highway, road, boulevard, square or other improved thoroughfare 9 m or more in width, that has been dedicated or deeded for public use, and that is accessible to fire department vehicles and equipment.

Suite means a single room or series of rooms of complementary use, operated under a single tenancy, and includes,

(a) dwelling units,

(b) individual guest rooms in motels, hotels, boarding houses, rooming houses and dormitories, and

(c) individual stores and individual or complementary rooms for *business and personal services occupancies*.

Supply duct means a duct for conveying air from a heating, ventilating or *air-conditioning appliance* to a space to be heated, ventilated or air-conditioned.

Theatre means a place of public assembly intended for the production and viewing of the performing arts or the screening and viewing of motion pictures, and consisting of an auditorium with permanently fixed seats intended solely for a viewing audience.

Trap means a fitting or device that is designed to hold a liquid seal that will prevent the passage of gas but will not materially affect the flow of a liquid.

Treatment unit means a device that, when designed, installed and operated in accordance with its design specifications, provides a specific degree of *sanitary sewage* treatment to reduce the contaminant load from that of *sanitary sewage* to a given *effluent* quality.

Unit heater means a suspended *space heater* with an integral air circulating fan.

Unprotected opening means, when applied to an exposing building face,

(a) a doorway, window or opening other than one equipped with a *closure* having the required *fire-protection rating*, or

(b) any part of a wall forming part of the *exposing building face* that has a *fire-resistance rating* less than required for the *exposing building face*.

Vacuum breaker means back-siphonage preventer.

Vapour barrier means the elements installed to control the diffusion of water vapour.

Vertical service space means a shaft that is oriented essentially vertically and that is provided in a *building* to facilitate the installation of building services, including mechanical, electrical and plumbing installations and facilities such as elevators, refuse chutes and linen chutes.

Water service pipe means a pipe on the property that conveys *potable* water from a *drinking-water system* or a *private water supply* to the inside of the *building*.

Water system means a *water service pipe*, a *private water supply*, a *water distribution system*, a *fire service main* or parts of any of them.

Abbreviations

Abbreviations of proper names in the OBC are defined in Part 1 of the OBC. Examples of commonly used abbreviations are:

ASHRAE	American Society of Heating, Refrigeration and Air-Conditioning Engineers
CAN	National Standard of Canada designation (the number or name following the CAN designation represents the agency under whose auspices the standard is issued. CAN1 designates CGA, CAN2 designates CGSB, CAN3 designates CSA, and CAN4 designates ULC.)
CSA	Canadian Standards Association
NBC	National Building Code of Canada
NFPA	National Fire Protection Association

Symbols

Common symbols and abbreviations of common words are defined in Part 1 of Division A of the OBC. Some examples include:

°C	degree(s) Celsius
HVAC	heating, ventilating and air-conditioning
kW	kilowatt(s)

Applicable Edition

The OBC references numerous documents published by various agencies that have established standards of quality and safety such as CSA, NFPA, ULC, and many others. It is important to note that the OBC applicable edition of a document is as specifically declared in Part 1 of the OBC and may not be the latest edition of the document available from the issuing agency.

STOP

EXAMPLE QUESTION

- Based on the OBC definition, *open air* means?
  - a) balcony *building* area;
  - b) ventilation from open windows;
  - c) atmosphere outside a *building;*
  - d) ventilation from openable skylights.

OBC Reference ______________________________

EXERCISE #1-3

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. Based on the OBC definition, what does a *service room* contain?

   a) *personal services occupancy;*
   b) electrical meters only;
   c) *building* services equipment;
   d) vehicle repair equipment.

OBC Reference ______________________________

2. Based on the OBC definition, which one of the following forms part of the definition of a *public spa*?
   a) a hydro-massage pool for the use of residents of a four-plex;
   b) an artificial body of water;
   c) a wading pool;
   d) a fountain containing air induction bubbles.

OBC Reference ______________________________

STOP

CLOSING COMMENTS

In preparation to attend this course, you are asked to complete as many of the exercises as you can. During the delivery of the course, you are asked to obey the STOP signs, the Facilitator will provide guidance to keep the course moving. Bring your questions and comments to the course and participate in all the discussions.

Your evaluation of the course and comments on its contents will be collected during the session. Your input is important, it enables the Building and Development Branch of the Ministry of Municipal Affairs to keep the course current and to meet your needs. In preparation, you are asked to note your comments on plain paper. They will be collected at the end of the course. You will also be asked to evaluate the Facilitator and the facilities where the course is being held, at the end of the course.

Unlike the course for the qualification examination, you will not be asked to provide references to support your answers. Nevertheless, you are strongly encouraged to find the supporting part of the OBC. Remember, you need to find a requirement before you can understand and apply it.

Ontario **Ministry of Municipal Affairs and Housing**

BUILDING SERVICES
PARTICIPANT'S MODULE #2

Energy Efficiency

INTRODUCTION

In this module the requirements for energy efficiency in *buildings* is examined with particular attention to ANSI/ASHRAE/IES 90.1 and to the Supplementary Standard to the OBC, SB-10, Energy Efficiency Supplement (July 1, 2011 Update).

OBJECTIVES

Upon completion of this module participants will be able to:

- Determine which *building* uses are covered;
- Understand the impact of SB-10 (July 1, 2011 Update) on the requirements of ANSI/ASHRAE/IES 90.1and the Model National Energy Code for Buildings, 1997.

STOP

ENERGY EFFICIENCY BEFORE JANUARY 1, 2012

Applies to the design and construction of buildings for which a permit has been applied for before January 1, 2012.

As per Article 12.2.1.1. of the Building Code, the energy efficiency of all *buildings* shall be designed to good engineering practice such as described in

- the ANSI/ASHRAE/IES 90.1-2004, "Energy Standard for Buildings Except Low-Rise Residential Buildings" and the Supplementary Standard SB-10 (July 1, 2011 Update), or
- the Model National Energy Code for Buildings, 1997 and Supplementary Standard SB-10 (July 1, 2011 Update).

Except for *buildings* of

- *residential occupancy* within the scope of Part 9,
- farm buildings, and
- *buildings* intended primarily for processing such as manufacturing, commercial, or industrial.

A test to determine which *building* rooms and spaces are covered by the requirements of 12.2.1.1. is human comfort. *Buildings* and rooms and spaces that have *building* services with a primary purpose of providing human comfort in the room and space are covered by 12.2.1.1.

ENERGY EFFICIENCY AFTER DECEMBER 31, 2011

Applies to the design and construction of buildings for which a permit has been applied for before January 1, 2012.

As per Article 12.2.1.2. of the Building Code, the energy efficiency of all *buildings* shall conform to Supplementary Standard SB-10 (July 1, 2011 Update). This Standard requires the energy efficiency design of buildings to meet one of the following three requirements:

- achieve the energy efficiency levels attained by conforming to the ANSI/ASHRAE/IES 90.1-2010, "Energy Standard for Buildings Except Low-Rise Residential Buildings" as modified by Chapter 2 of Division 3 of the Supplementary Standard SB-10 (July 1, 2011 Update),
- exceed by not less than 5% the energy efficiency levels attained by conforming to the ANSI/ASHRAE/IES 90.1-2010, "Energy Standard for Buildings Except Low-Rise Residential Buildings" , or
- exceed by not less than 25% the energy efficiency levels attained by conforming to the 1997 Edition of CCBFC, "Model National Energy Code for Buildings."

Where compliance with energy efficiency requirements is achieved by conforming to 5% ASHRAE 90.1-2010 approach, energy efficiency of the building or part of the building is permitted to conform to the respective requirements of Chapter 2 of Division 3 of SB-10 in lieu of the corresponding requirements in ANSI/ASHRAE/IESNA Standard.

Except for

- buildings of residential occupancy within the scope of Part 9,
- farm buildings,
- heritage buildings,
- any building space that uses energy at a rate less than 12 W/m^2 under peak conditions,
- temporary structures such as trailers, tents,
- warehouse and storage rooms where design indoor temperature does not exceed 10°C ,
- unheated storage garages and unheated storage rooms except for conditioned spaces of buildings exposed to unheated storage garages and unheated storage rooms, and
- *buildings* intended primarily for processing such as manufacturing, commercial, or industrial.

SB-10, Energy Efficiency Supplement (July 1, 2011 Update) - Intent

The intent of SB-10 is to clarify and modify certain requirements of ANSI/ASHRAE/IES 90.1 (Standard 90.1) and the Model National Energy Code for Buildings (MNECB) to ensure compatibility with Canadian climatic conditions and Canadian construction practices. In addition, the standard contains modifications to enhance building envelope provisions of Standard 90.1 and enable the use of Canadian testing procedures for buildings constructed after December 31, 2011.

In all cases, the OBC, along with the Supplementary Standards and other applicable law, supercedes those requirements of Standard 90.1. An example is the case where the provisions of the Energy Efficiency Act are more restrictive than the requirements of Standard 90.1

Introduction

SB-10 contains additions and/or substitutions to Standard 90.1 and the Model National Energy Code for Buildings, 1997. Comments and interpretations are provided for sections of the Standard, where appropriate.

The section numbers in the main body of Division 2 SB-10 match those in of ANSI/ASHRAE/IES 90.1 to directly identify those areas of the Standard that have been subject to addition and/or substitution.

Applicable Standards

Standard 90.1 references a number of ASHRAE (American Society of Refrigeration and Air-conditioning Engineers) and IES (Illuminating Engineering Society) manuals, standards and publications. Standard 90.1 also references other component testing and rating standards, generally American, which may currently be in use in Ontario, or may be replaced by a Canadian standard. All references, except as otherwise specified in the OBC, are to include amendments, revisions, and supplements effective to May 18, 2011.

STOP

EXAMPLE QUESTION

Summarize the intent or purpose of SB-10?

Answer: ____

____

____

OBC Reference ____________________________________

EXERCISE #2-1

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice or search and record method.

- Read through Section 1.2 of Division 2 of SB-10 and summarize the exemption bases for certain buildings?

Answer:

OBC Reference

- Which one of the following arrangements and conditions describe a *building* that is required to conform to OBC 12.2.1.1. and Standard 90.1 if the permit is applied in 2011?
  - a) Peak energy rate 32 W/m^2, building area of 1000 m^2, chicken hatchery;
  - b) Peak energy rate 10 W/m^2, building area of 1000 m^2, office;
  - c) Peak energy rate 10 W/m^2, building area of 1000 m^2, warehouse, indoor design temp 10°C;
  - d) Peak energy rate 15 W/m^2, building area of 10 m^2, retail shop.

Answer:

OBC Reference

STOP

SB-10 ENERGY EFFICIENCY SUPPLEMENT (JULY 1, 2011 UPDATE) – CONTENT

The supplementary standard contains 4 Divisions, as follows:

- Division 1 addresses general requirements
- Division 2 applies to construction for which a permit has been applied for before January 1, 2012
- Division 3 applies to construction for which a permit has been applied for after December 31, 2011
- Division 4 contains simplified energy efficiency requirements for the construction of certain non-residential buildings with the scope of Part 9 of OBC for which a permit has been applied for after December 31, 2011

The following is a summary of the information contained in the Divisions of SB-10.

DIVISION 2:

Chapter 2

Chapter 2, "Supplement to ANSI/ASHRAE/IESNA Standard 90.1" outlines changes and clarification of requirements of Standard 90.1 for use with the OBC on a per section basis matching the sections of Standard 90.1.

Section 4 - Administration and Enforcement

The compliance paths for new and existing buildings are clarified. New buildings and additions to existing buildings are to comply with either Sections 5 to 10 or Section 11. Change of use of existing buildings is to comply with Part 10, while renovations to existing buildings are to comply with Part 11 of the OBC.

Section 5 - Building Envelope

Interpretations and revisions are given for calculation procedures and climatic data in the establishment of building envelope design. This section primarily affects designers of the building envelope for required performance targets.

Section 6 - Heating, Ventilating and Air-Conditioning

As per Article 6.4.1.4, minimum equipment efficiency requirements are provided in Table 6.8.1A to Table 6.8.1G. Equipment efficiencies are required to be verified as follows:

- equipment covered under the Green Energy Act, 2009 shall comply with the Ontario Ministry of Energy certification requirements,
- where a certification program exists for a covered product, and it includes provisions for verification and challenge of equipment efficiency ratings,
- then the product shall be listed in the certification program,
- but the product is not listed in the existing certification program, the ratings shall be verified by an independent laboratory test report, or
- where a certification program does not exist for a covered product, the equipment efficiency ratings shall be supported by data furnished by the manufacturer, or
- where components such as indoor or outdoor coils from different manufacturers are used, the system designer shall specify component efficiencies whose combined efficiency meets the minimum equipment efficiency requirements in 6.4.1 for commercial applications. Application for houses differs;
- products covered in Table 6.8.1G shall have efficiency ratings supported by data furnished by the manufacturer.

Section 7 - Service Water Heating Systems and Equipment

As per Subsection 7.4.2., all water heating equipment, hot water supply boilers used solely for heating potable water, pool heaters, and hot water storage tanks shall meet the criteria listed in Table 7.8.

The minimum efficiency values of the Green Energy Act, 2009 shall apply if provided, otherwise Standard 90.1 applies.

A requirement for pool covers reflects Canadian climatic reality along with exemptions for site-recovered or site-solar energy.

Section 9 - Lighting

Revisions are made to lighting control requirements and to Table 9.1.5.1, Fluorescent Lamp Ballast Efficacy Factors, lighting power allowance calculations, lighting power budget procedure, and interior lighting power allowance.

Section 10 - Other Equipment

Where electric motors are regulated by the Green Energy Act, 2009, the efficiency levels shall be based on CSA-C390-M, "Energy Efficiency Test for Three-Phase Induction Motors". Minimum nominal efficiency for motors is provided in Table 10.8 of SB-10.

Section 11 - Energy Cost Budget Methos

Clarifications and modification for energy modeling in terms of building envelope design are made along with energy cost basis for building permit applications.

Chapter 3

Chapter 3, "Supplement to MNECB" outlines changes and clarification of requirements of the MNECB for use with the OBC on a per part basis matching the parts of the MNECB. These provisions are more stringent than the MNECB and the performance level has been increased.

Part 3 - Building Envelope

The requirements of Part 3 are replaced by the requirements of Section 5 of Chapter 2 of Division 2 of SB-10.

Part 4 - Lighting

Exterior lighting levels are required to meet Table 4.2.1.2 in Chapter 2 of Division 2 of SB-10.

Fluorescent ballast efficacy factors are required to meet Table 9.1.5.1 in Chapter 2 of Division 2 of SB-10.

Interior lighting power densities are required to meet Tables 4.3.2.1. and 4.3.3.4. in Chapter 2 of Division 2 of SB-10..

Part 5 - Heating, Ventilating and Air-Conditioning Systems

The efficiencies of unit and packaged equipment are required to meet Tables 6.8.1A – G in Chapter 2 of Division 2 of SB-10.

Part 6 - Service Water Heating Systems

The efficiencies of storage vessels and heating equipment are required to meet Table 7.8. in Chapter 2 of Division 2 of SB-10.

Part 7 - Electrical Power

The efficiencies of electric motors are required to meet Table 10.8 in Chapter 2 of Division 2 of SB-10.

STOP

EXAMPLE QUESTION

With a ballast input voltage of 120 V for a 40 W F40T12 fluorescent lamp, what is the required BEF?

Answer: ______________________________

____

____

____

OBC Reference ______________________________

EXERCISE #2-2

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice or search and record method.

- An air-cooled condensing cooling tower has a capacity of 175 kW. What test procedure is required for verification of energy efficiency to meet Standard 90.1?
    - e) Independent lab test report
    - f) CTI ATC-105
    - g) ARI 460
    - h) CAN/CSA-C390-M

OBC Reference ______________________________

- A health club has a heated outdoor pool.
  Which one of the following initiatives, as per ASHRAE90.1 design, will exempt the health club from providing a pool cover for the pool?
  - i) limit use to 60% of club operating hours
  - j) maintain a pool temperature of no greater than 60°F
  - k) 60% of pool heating energy obtained from on-site heat recovery process
  - l) no initiative required, lap pools are excluded

OBC Reference ______________________________

STOP

DIVISION 3:

Chapter 1

Chapter 1 contains the application, energy efficiency design requirements and exemptions to ANSI/ASHRAE/IESNA Standard 90.1-2010. It also contains climatic zones applicable to Ontario.

Refer to Energy Efficiency after December 31, 2011 provided on pages 2 and 3 for the application of Division 3. Chapter 2

Chapter 2, "Additional Requirements to ANSI/ASHRAE/IESNA Standard 90.1" outlines additions and/or substitutions to ANSI/ASHRAE/IESNA Standard 90.1-2010 for use with the OBC for buildings of which a permit has been applied for after December 31, 2011.

Building Envelope

Building envelope requirements in ANSI/ASHRAE/IESNA Standard 90.1-2010 have been superseded by requirements of SB-10. Tables SB5.5-5 to SB5.5-7 of Chapter 2 of Division 3 of SB-10 shall supersede the requirements of Tables 5.5-5 to 5.5-7 of ANSI/ASHRAE/IESNA Standard 90.1. SB-10 also includes additional insulation requirements for exposed frame floors based on framing depth.

Tables SB5.5-5 to SB5.5-7 of Chapter 2 of Division 3 specify the minimum R-values for insulation and the maximum U-factors for building envelope construction assemblies. Both U-factors and R-values are used to describe steady-state heat flow. The U-factor is the reciprocal of the total resistance (R-value).

Alternative combinations of insulation R-values are permitted provided the combinations are designed in accordance with "Normative Appendix A" of ANSI/ASHRAE/IESNA 90.1.

The Series and Parallel methods are the most commonly used calculation methods to determine U-factors. Calculating U-factors using specific computer software is also an acceptable method to determine U-factors. ASHRAE standard provides alternative methods to calculate the U-factors.

Series Calculation Method – The thermal resistance of each layer in the construction assembly is determined. This method is limited to construction that has no framing and made of homogenous materials.

Parallel Path Calculation Method – An extension of the series calculation. There is one calculation for the cavity portion of the surface and one for the framing portion.

Essentially, a series of calculations are made to determine the cavity portion of the roof, wall or floor (surfaces) and for the framing portion of the wall.

In some cases the wall or surface area must be broken down to determine the U-factor for that specific area. In those cases, the U-factor is weighted according to surface area.

Isothermal Planes Method – This calculation is appropriate for walls made of concrete or concrete masonry units.

Modified Zone Method – Used with roof, floor and wall construction made of metal framing.

Two- Dimensional Heat Flow – This method may be used to accurately predict the U-factor of a complex construction assembly.

More information regarding the methods of calculation can be found in the User's Manual for ASHRAE Standard 90.1.Equipment Test Procedures

Chapter 2 of Division 3 of SB-10 permits the use of Ontario Testing procedures for Heating Ventilation and Air Conditioning Equipment and Service Water Heating Equipment. Where the test procedure of equipment is not regulated by an Ontario Regulation, the applicable test procedure can be selected from Column 4 or Column 5 of Table 6.4.1.A.2.

Lighting and Other Equipment – the minimum efficiency of an electric motor that is within the scope of ANSI/ASHRAE/IESNA Standard 90.1 and regulated by an Ontario Regulation, shall comply with efficiency requirements of Table 10.4.1.A.(a) or Table 10.4.1.A.(b) of Chapter 2 of Division 3 of SB-10.

DIVISION 4:

Division 4 contains simplified energy efficiency requirements for the construction of certain non-residential buildings with the scope of Part 9 of OBC for which a permit has been applied for after December 31, 2011.

Energy efficiency requirements include:

- Building Envelope
- Air Infiltration
- Heating, Ventilation and Air Conditioning
- Ducts, Plenums and piping
- Service Water Heating
- Lighting
- Interior Lighting
- Interior Lighting Controls
- Exterior Lighting Controls
- Electric Motors

Ontario

Ministry of Municipal Affairs and Housing

BUILDING SERVICES

PARTICIPANT'S MODULE #3

Services in Combustible and Noncombustible Construction

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INTRODUCTION

In this module the requirements for building services installed in *buildings* of *combustible* and *noncombustible construction* are examined. The building services involved range from wires and cables to combustible piping and ducts to specialty wiring in computer rooms.

OBJECTIVES

Upon completion of this module participants will be able to:

- Know the requirements for Wires and Cables in Combustible Construction;
- Understand the restrictions of combustible Building Services in Noncombustible Construction.

STOP

SERVICES IN COMBUSTIBLE CONSTRUCTION

Wires and Cables

As per Article 3.1.4.3., optical fibre cables and electrical wires and cables installed in a *building* permitted to be of *combustible construction* must

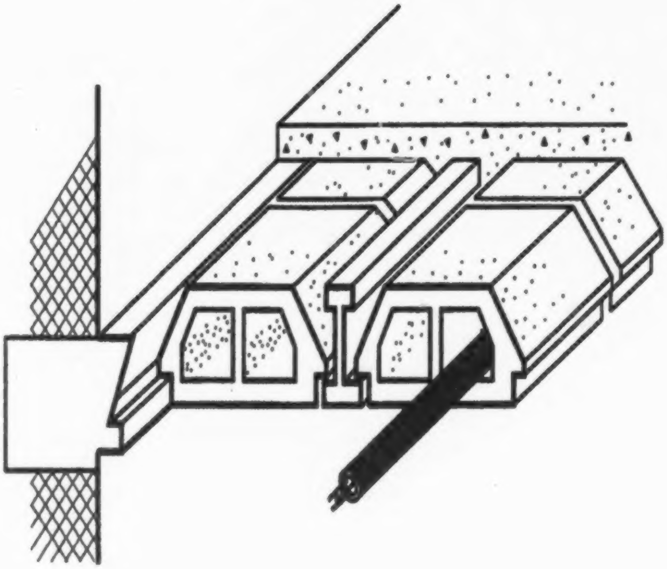
- not convey flame or continue to burn for more than 1 min when tested in conformance with the Vertical Flame Test in Clause 4.11.1. of CAN/CSA-C22.2 No. 0.3, "Test Methods for Electrical Wires and Cables", or must be located in

- totally enclosed *noncombustible* raceways,

- concealed spaces in walls,

- concrete slabs, or

- totally enclosed nonmetallic raceways conforming to 3.1.5..20



WIRING LOCATED WITHIN A
CONCRETE FLOOR SLAB

FIGURE 3-1

Exceptions

Article 3.1.4.3. states that service -entrance cables for communication and community antennae distribution systems need not conform to the above requirement

- the service-entrance cables are located in a *building* permitted to be of *combustible construction* and are not more than 3 m in length from the point of entry into the *building* or from the point of leaving protection as required in 3.1.4.3.(1)(b), or

- the service entrance cables enter into an electrical or telephone *service room* separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h.

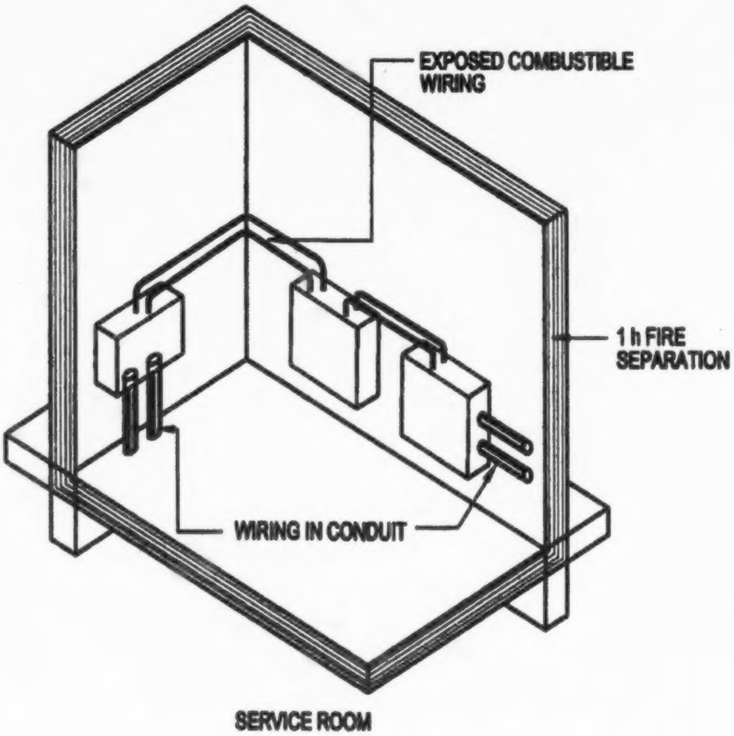


FIGURE 3-2

Alternate Consideration for 3.1.4.3.(1)(a)

The requirement is considered to be met where the wires and cables

- exhibit a vertical char of not more than 1.5 m when tested in conformance with the Vertical Flame Test - Cables in Cabletrough in Clause 4.11.4. of CSA C22.2 No. 0.3, "Test Methods for Electrical Wires and Cables" (FT4 Rating), or
- exhibit a flame-spread of not more than 1.5 m, a smoke density of not more than 0.5 at peak optical density and a smoke density not more than 0.15 at average optical density when tested in conformance with the Flame and Smoke Test in the Appendix to CSA C22.2 No. 0.3, "Test Methods for Electrical Wires and Cables" (FT6 Rating).

SERVICES IN NONCOMBUSTIBLE CONSTRUCTION

Combustible Ducts

Combustible ducts, including *plenums* and duct connectors, are permitted in a *building* required to be of *noncombustible construction* provided these ducts and duct connectors are used only in horizontal runs as per Article 3.1.5.15..

Exception: When a concealed space is used as a *plenum* it is required that all materials within the concealed space have a *flame-spread rating* not more than 25 and a smoke developed classification not more than 50 by 3.6.4.3.(1).

In a *building* required to be of *noncombustible construction*, *combustible* ducts need not comply with the requirements of Part 6 provided the ducts are

- part of a duct system conveying only ventilation air, and
- contained entirely within a *dwelling unit*.

Combustible duct linings, duct coverings, duct insulation, vibration isolation connectors, duct tape, pipe insulation and pipe coverings are permitted to be used in a *building* required to be of *noncombustible construction* provided they conform to the appropriate requirements of Part 6.

Combustible Piping Materials

Combustible piping and tubing and associated adhesives are permitted by Article 3.1.5.16. to be used in a *building* required to be of *noncombustible construction* provided that, except when concealed in a wall or concrete floor slab, they

- have a *flame-spread rating* not more than 25, and
- if used in a *building* described in 3.2.6., have a smoke developed classification not more than 50.

Permitted Exceptions

As per Article 3.1.5.2., tubing for pneumatic controls is permitted provided it has an outside diameter not more than 10 mm.

Combustible fittings and components in a *public pool* or *public spa*, including main drains, piping, skimmers, return inlets, steps, ladder rungs and liners, are permitted in a *building* required to be of *noncombustible construction* as per Article 3.1.5.22.

Combustible sprinkler piping is permitted by Article 3.1.5.16. for use within a *sprinklered floor area* in a *building* required to be of *noncombustible construction*.

Polypropylene pipes and fittings are permitted by Article 3.1.5.16. to be used for drain, waste and vent piping for the conveyance of highly corrosive materials and for piping used to distribute distilled or dialyzed water in laboratory and hospital facilities in a *building* required to be of *noncombustible construction*, provided

- the *building* is *sprinklered*,
- the piping is not located in a vertical shaft, and
- piping that penetrates a *fire separation* is sealed at the penetration by a fire stop system that, when subjected to the fire test method in CAN4-S115-M, "Fire Tests of Firestop Systems", has an FT rating not less than the *fire-resistance rating* of the *fire separation*.

STOP

EXAMPLE QUESTION

- Wires and cables installed in a *building* permitted to be of *combustible construction* are to conform to Sentence 3.1.4.3.(1). What conditions allow an exception for communication and community antennae distribution systems and service entrance cables entering into an electrical or telephone *service room* that is separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h ?

Answer: ______________________________

____

____

OBC Reference ______________________________

EXERCISE #3-1

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice or search and record method.

1. Wiring not in conformance with the Vertical Flame Test in Clause 4.11.1. of CAN/CSA-C22.2 No. 0.3, "Test Methods for Electrical Wires and Cables" is used in a building of *combustible construction*. Which one of the following installation locations does NOT meet the requirements of the OBC?
    a) concrete slabs
    b) concealed spaces in walls
    c) electrical riser room
    d) totally enclosed nonmetallic raceways conforming to 3.1.5.20.

OBC Reference ______________________________

2. Which of the following diameters of noncombustible tubing for pneumatic controls may be used in buildings required to be of noncombustible construction?
   a) 10 mm
   b) 100 mm
   c) 11 mm
   d) all diameters

OBC Reference ____________________

3. In a *building* required to be of *noncombustible construction*, *combustible* ducts contained entirely within a *dwelling unit* need not comply with the requirements of Part 6 provided the ducts are?
   a) insulated;
   b) convey only exhaust air;
   c) only used between the main duct and outlet, 4 m maximum length;
   d) convey only ventilation air.

OBC Reference ____________________

STOP

WIRES AND CABLES

As per Article 3.1.5.18., optical fibre cables and electrical wires and cables with *combustible* insulation, jackets or sheathes are permitted in a *building* required to be of *noncombustible construction*, provided

- the wires and cables exhibit a vertical char of not more than 1.5 m when tested in conformance with the Vertical Flame Test – Cables in Cabletrough in Clause 4.11.4. of CAN/CSA-C22.2 No. 0.3, "Test Methods for Electrical Wires and Cables" (FT4 Rating),

- the wires and cables are located in
    - totally enclosed *noncombustible* raceways,
    - concealed spaces in walls,
    - concrete slabs,
    - a *service room* separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h, or
    - totally enclosed nonmetallic raceways conforming to 3.1.5.20., or
- the wires and cables are communication cables used at the service entry to a *building* and are not more than 3 m long.

Exceptions

Combustible travelling cables are permitted on elevating devices in a *building* required to be of *noncombustible construction,* as per Article 3.1.5.19.,

and wires in computer room floors as per Article 3.1.5.21..

Alternate Consideration for 3.1.5.18.(1)(a)

As stated in Article 3.1.5.18., the requirement is considered to be met where the wires and cables exhibit

- a flame-spread of not more than 1.5 m,
- a smoke density of not more than 0.5 at peak optical density and
- a smoke density not more than 0.15 at average optical density

when tested in conformance with the Flame and Smoke Test in the Appendix to CSA C22.2 No. 0.3, "Test Methods for Electrical Wires and Cables" (FT6 Rating).

NONMETALLIC RACEWAYS

Totally enclosed nonmetallic raceways not more than 175 mm in outside diameter, or equivalent rectangular area, are permitted by Article 3.1.5.20. to be used in a *building* required to be of *noncombustible construction* to enclose optical fibre cables and electrical wires and cables, provided the raceways exhibit a vertical char not more than 1.5 m when tested in conformance with the Test for Flame Propagation (Riser) in Section 3.4 of the ULC/ORD-C2024 "Fire Tests for Optical Fibre Cable Raceways" (FT4 Rating.

WIRES IN COMPUTER ROOM FLOORS

As per Article 3.1.5.21., optical fibre cables and electrical wires and cables with *combustible* insulation, jackets or sheathes, located in the space below a raised floor in a *computer room*, are permitted in a *building* required to be of *noncombustible construction* provided

- they do not convey flame or
- continue to burn for more than 1 min

when tested in conformance with the Vertical Flame Test in Clause 4.11.1. of CSA C22.2 No. 0.3, "Test Methods for Electrical Wires and Cables" (FT1 Rating).

Alternate Consideration

The above requirement is considered to be met where the wires and cables

- exhibit a vertical char of not more than 1.5 m when tested in conformance with the Vertical Flame Test – Cables in Cabletrough in Clause 4.11.4. of CSA C22.2 No. 0.3, "Test Methods for Electrical Wires and Cables" (FT4 Rating), or
- exhibit a flame-spread of not more than 1.5 m, a smoke density of not more than 0.5 at peak optical density and a smoke density not more than 0.15 at average optical density when tested in conformance with the Flame and Smoke Test in the Appendix to CSA C22.2 No. 0.3,

"Test Methods for Electrical Wires and Cables" (FT6 Rating).

STOP

EXAMPLE QUESTION

- Optical fibre cables and electrical wires and cables with *combustible* insulation, jackets or sheathes, in a raised floor in a *computer room*, are permitted in a *building* of *noncombustible construction* provided they do not convey flame or continue to burn for more than 1 min when tested in conformance with CSA C22.2 No. 0.3. Explain the alternate consideration to this requirement?

Answer: ______________________________

____

____

OBC Reference ______________________________

EXERCISE #3-2

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice or search and record method.

1. List two requirements of totally enclosed nonmetallic raceways permitted to be used in a *building* required to be of *noncombustible construction* to enclose optical fibre cables and electrical wires and cables?

Answer: ______________________________

____

____

OBC Reference ______________________________

2. In a *building* required to be of *noncombustible construction combustible*, *combustible* communication and power cables are allowed on which one of the following devices?
    a) voice communication speakers;
    b) elevators;
    c) security cameras;
    d) hanging lighting.

OBC Reference ______________________________

STOP

Ontario Ministry of Municipal Affairs and Housing

BUILDING SERVICES

PARTICIPANT'S MODULE #4

Openings and Fire Dampers

JAN06

INTRODUCTION

This module covers fire separations and closures as they relate to building services. Ratings for required closures are discussed along with maximum opening sizes. Fire dampers, their installation, and circumstances where they may be omitted are also discussed.

OBJECTIVES

Upon completion of this module participants will:

- Understand the concept of a Fire Separation;
- State the concept of openings in Fire Separations;
- Determine the required fire protection rating of a closure device;
- Know when Fire Dampers are required or can be waived;
- Find the requirements for installation of fire dampers.

STOP

FIRE SEPARATIONS AND CLOSURES (DEFINITION REVIEW)

Closure means a device or assembly for closing an opening through a *fire separation* or an exterior wall, such as a door, a shutter, wired glass and glass block, and includes all components such as hardware, closing devices, frames and anchors.

Fire separation means a construction assembly that acts as a barrier against the spread of fire.

Fire-resistance rating means the time in minutes or hours that a material or assembly of materials will withstand the passage of flame and the transmission of heat when exposed to fire under specified conditions of test and performance criteria, or as determined by extension or interpretation of information derived from that test or performance as prescribed in this Code.

Determination of Ratings

As per Article 3.1.8.4., the *fire-protection rating* for a *closure* is to be determined on the basis of the results of tests conducted in conformance with the appropriate provisions in

CAN4-S104-M, "Fire Tests of Door Assemblies",

CAN4-S106-M, "Fire Tests of Window and Glass Block Assemblies", or

CAN/ULC-S112-M, "Fire Test of Fire-Damper Assemblies".

Exceptions

In 3.1.8.14.(1), an opening in a *fire separation* having a *fire-resistance rating* not more than 1 h is permitted to be protected with fixed wired glass assemblies or glass blocks installed in conformance with NFPA 80, "Fire Doors and Fire Windows".

The *fire-protection rating* of a *closure* is to conform to Table 3.1.8.4. for the required *fire-resistance rating* of the *fire separation*.

TABLE 4-1
Table 3.1.8.4.
Fire Protection Rating of Closure
Forming Part of Sentence 3.1.8.4.(2)

Fire-Resistance Rating of Fire Separation	Required *Fire-Protection Rating of Closure*
30 min	20 min
45 min	45 min
1 h	45 min
1.5 h	1 h
2 h	1.5 h
3 h	2 h
4 h	3 h
Column 1	2

Exception: In 3.1.8.10.(1) a door assembly having a *fire-protection rating* not less than 20 min is permitted to be used as a *closure* in a *fire separation* not required to have a *fire-resistance rating* more than 1 h, in specified locations.

Maximum Openings

The size of an opening in an interior *fire separation* required to be protected with a *closure* must be not more than 11 m^2, with no dimension more than 3.7 m, if a *fire compartment* on either side of the *fire separation* is not *sprinklered* as per Article 3.1.8.6.

The size of an opening in an interior *fire separation* required to be protected with a *closure* must be not more than 22 m^2, with no dimension more than 6 m, provided the *fire compartments* on both sides of the *fire separation* are *sprinklered*.

Fire Dampers

A duct that connects 2 *fire compartments* or that penetrates an assembly required to be a *fire separation* is to be equipped with a *fire damper* as per Article 3.1.8.7.

A *fire damper* required above or a *fire damper* used as a *closure* in a *fire separation* is to have a *fire-protection rating* conforming to Table 3.1.8.4. **Exception:** as permitted by Article 3.1.8.8.

Installation of Fire Dampers

A *fire damper* is required by Article 3.1.8.9. to be arranged to close automatically upon the operation of a fusible link conforming to ULC-S505, "Fusible Links for Fire Protection Service", or other heat-actuated or smoke-actuated device.

A heat-actuated device referred to above is to

- be located where it is readily affected by an abnormal rise of temperature in the duct, and
- have a temperature rating approximately 30°C above the maximum temperature that would exist in the system either with the system in operation or shut down.

A *fire damper* is to be installed in the plane of the *fire separation* so as to stay in place should the duct be dislodged during a fire.

A *fire damper* tested in the vertical or horizontal position is to be installed in the manner in which it was tested.

A tightly fitted access door is to be installed for each *fire damper* to provide access for the inspection of the damper and the resetting of the release device.

STOP

EXAMPLE QUESTION

- Summarize the differences in the requirements and allowances for maximum openings in interior fire separations to be protected by a closure.

Answer: ____

____

____

____

OBC Reference ______________________________________

EXERCISE #4-1

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice or search ad record method.

1. A *fire damper* is to be arranged to close automatically upon the operation of one of three devices. Describe them.

Answer: ____

____

____

OBC Reference ______________________________________

2. A duct connects 2 *fire compartments* and penetrates an assembly permitted to include a door assembly having a *fire-protection rating* of 20 min. Which one of the following times is the maximum allowable for the *fire-resistance rating* of the *fire separation*?
   a) 20 min
   b) 30 min
   c) 1 h
   d) 45 min

OBC Reference ______________________________________

3. Why is a *fire damper* to be installed in the plane of the *fire separation*?

Answer: ____

____

____

OBC Reference ______________________________________

FIRE DAMPERS WAIVED

Article 3.1.8.8. outlines the exceptions where fire dampers are not required.

Fire dampers need not be provided in *noncombustible* branch ducts that have a melting point above 760°C and that penetrate a required *fire separation* provided the ducts

- serve only air-conditioning units or combined air-conditioning and heating units discharging air not more than 1 200 mm above the floor (sketch below for induction units) and have a cross-sectional area not more than 0.013 m^2, or

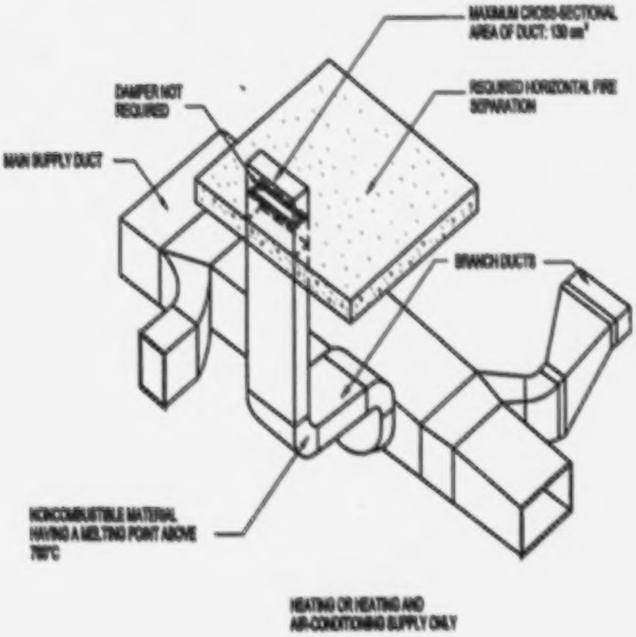

MAXIMUM CROSS-SECTIONAL AREA OF DUCT: 130 cm²
DAMPER NOT REQUIRED
REQUIRED HORIZONTAL FIRE SEPARATION
MAIN SUPPLY DUCT
BRANCH DUCTS
NONCOMBUSTIBLE MATERIAL HAVING A MELTING POINT ABOVE 760°C
HEATING OR HEATING AND AIR-CONDITIONING SUPPLY ONLY

FIGURE 4-1

- are connected to exhaust duct risers that are under negative pressure and in which the air flow is upward as required by Article 3.6.3.4. and are carried up inside the riser not less than 500 mm (sketch below).

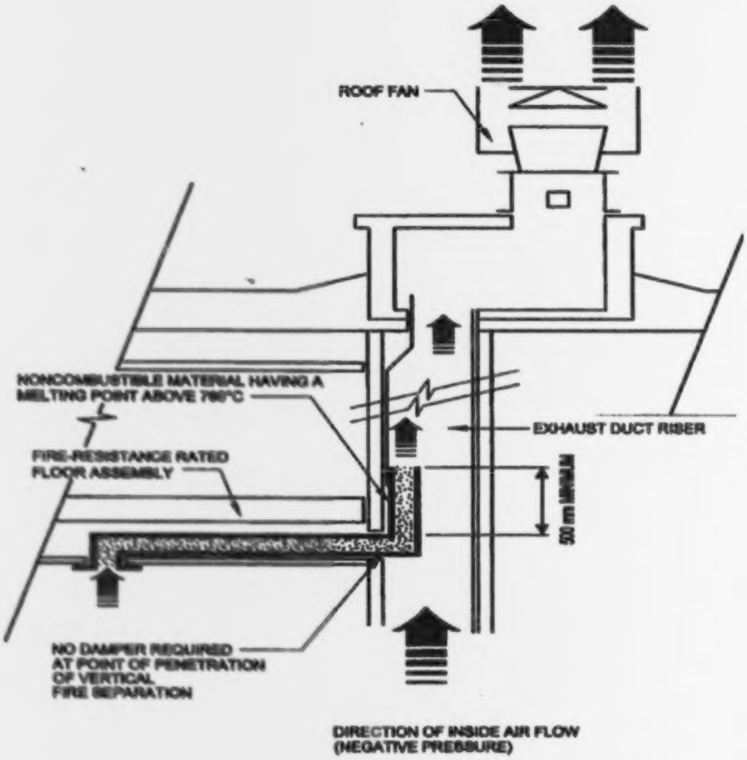

ROOF FAN
NONCOMBUSTIBLE MATERIAL HAVING A MELTING POINT ABOVE 760°C
FIRE-RESISTANCE RATED FLOOR ASSEMBLY
EXHAUST DUCT RISER
500 mm MINIMUM
NO DAMPER REQUIRED AT POINT OF PENETRATION OF VERTICAL FIRE SEPARATION
DIRECTION OF INSIDE AIR FLOW (NEGATIVE PRESSURE)

FIGURE 4-2

A continuous *noncombustible* duct penetrating a vertical *fire separation* not required to have a *fire-resistance* rating need not be equipped with a *fire damper* at the *fire separation*.

A *noncombustible* duct that penetrates a horizontal *fire separation* not required to have a *fire-resistance rating* need not be equipped with a *fire damper* at the *fire separation*.

A *noncombustible* duct that penetrates a *fire separation* that separates a *vertical service space* from the remainder of the *building* need not be equipped with a *fire damper* at the *fire separation* provided

- the duct has a melting point above 760°C, and
- each individual duct exhausts directly to the outside at the top of the *vertical service space* (multiple outlet exhaust cluster is to permit nondampening of certain

types of exhaust ducts, including ducts from fume hoods and kitchen exhaust systems, that otherwise are impractical or problematic to fire damper).

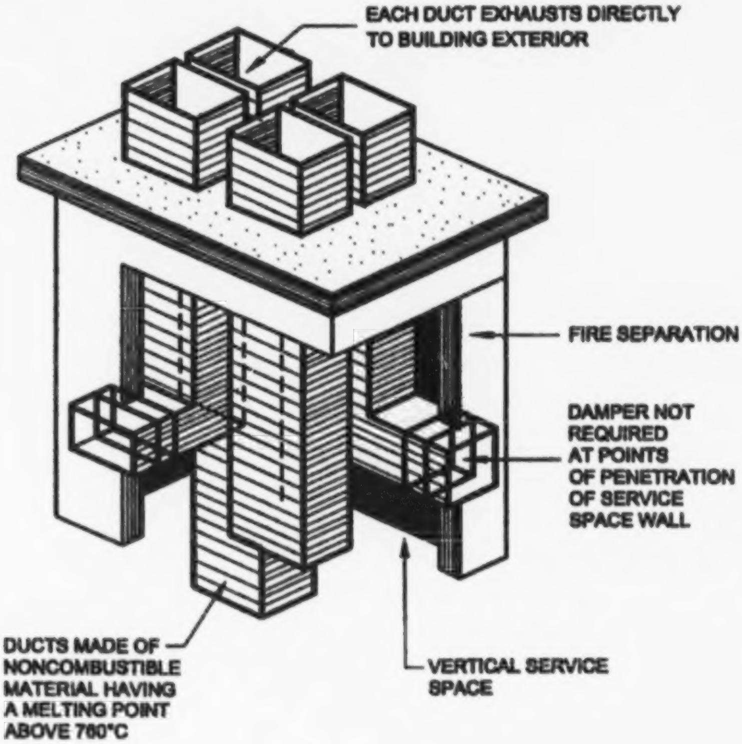

EACH DUCT EXHAUSTS DIRECTLY TO BUILDING EXTERIOR
FIRE SEPARATION
DAMPER NOT REQUIRED AT POINTS OF PENETRATION OF SERVICE SPACE WALL
DUCTS MADE OF NONCOMBUSTIBLE MATERIAL HAVING A MELTING POINT ABOVE 760°C
VERTICAL SERVICE SPACE

FIGURE 4-3

A continuous *noncombustible* duct having a melting point above 760°C that penetrates a vertical *fire separation* having a *fire-resistance rating* between *suites* of other

- than *residential* or
- *care or detention* or
- *business and personal services occupancy,*

need not be equipped with a *fire damper* at the *fire separation*.

A duct that serves commercial cooking equipment and penetrates a required *fire separation* need not be equipped with a *fire damper* at the *fire separation*.

In elementary and secondary schools, a continuous *noncombustible* duct having a melting point above 760°C that pierces a *fire separation* having a *fire-resistance rating* of 30 min need not be equipped with a *fire damper* at the *fire separation*.

In a Group B, Division 3 *occupancy* that contains sleeping accommodation for not more than 10 persons and not more than 6 occupants require assistance in evacuation in case of an emergency and which is equipped with a fire-alarm system, a duct need not be provided with a *fire-damper* at a fire separation provided duct-type *smoke detectors* have been installed to control smoke circulation as described in Article 3.2.4.12 for the prevention of smoke circulation. This applies to those fire separations that are not required to have a fire resistance rating.

STOP

EXAMPLE QUESTION

- A central air-conditioning system supplies air by a duct (that penetrates a required fire separation) to a combined air-conditioning and heating unit. What are the requirements for waiving the requirement for a fire damper in the duct?

Answer: ______________________________

____

OBC Reference ______________________________

EXERCISE #4-2

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice or search and record method.

1. What are the requirements and allowances for the waiving of *fire dampers* in *fire separations* not required to have a *fire-resistance* rating?

Answer:

OBC Reference

2. A continuous *noncombustible* duct having a melting point above 760°C pierces a *fire separation* having a *fire-resistance rating* of 30 min. Under which one of the following building *occupancy* and use conditions is the requirement for a *fire damper* waived?
    a) a college classroom
    b) an elementary school
    c) a nursery school
    d) a Sunday school

OBC Reference

STOP

Ontario

Ministry of Municipal Affairs and Housing

BUILDING SERVICES

PARTICIPANT'S MODULE #5

Building Services in Fire Separations and Fire Rated Assemblies

JAN06

INTRODUCTION

This module examines the interrelationship between *building* services and *fire separations* and fire rated assemblies. Fire stopping of services penetrations, combustibility of service penetrations, and openings in a membrane ceiling forming part of a fire rated assembly are reviewed for requirements affecting *building* services design, arrangement, and installation.

OBJECTIVES

Upon completion of this module participants will:

- Understand the concept of Fire Separation and Fire Rated Assembly Penetration;
- Determine the allowances and restrictions for Building Services in Fire separations and Fire Rated Assemblies;
- Know the concept of Fire Stopping;
- Determine the requirements for Openings through a Membrane Ceiling.

STOP

FIRE STOPPING OF SERVICE PENETRATIONS

Penetrating a Membrane

As per Article 3.1.9.1., piping, tubing, ducts, *chimneys*, optical fibre cables, electrical wires and cables, totally enclosed *noncombustible* raceways, electrical outlet boxes and other similar *building* services that penetrate a membrane forming part of an assembly required to have a *fire-resistance rating*, or a *fire separation*, are to be

- tightly fitted, or
- sealed by a fire stop system that, when subjected to the fire test method in ULC-S115, "Fire Tests of Firestop Systems", has an F rating not less than the *fire-protection rating* required for *closures* in the *fire separation*.

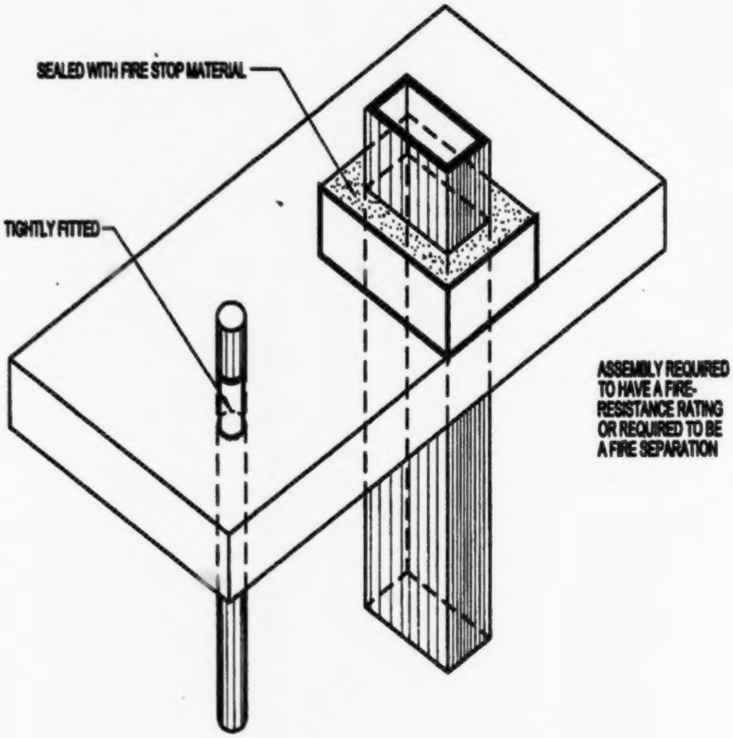

SEALED WITH FIRE STOP MATERIAL
TIGHTLY FITTED
ASSEMBLY REQUIRED TO HAVE A FIRE-RESISTANCE RATING OR REQUIRED TO BE A FIRE SEPARATION

FIGURE 5-1

Penetrating a Firewall or Horizontal Fire Separation

Piping, tubing, ducts, *chimneys*, optical fibre cables, electrical wires and cables, totally enclosed *noncombustible* raceways, electrical outlet boxes and other similar *building* services that penetrate

- a *firewall* or
- a horizontal *fire separation* that is required to have a *fire-resistance rating* in conformance with Article 3.2.1.2.,

are required by Article 3.1.9.1. to be sealed at the penetration by a fire stop system that, when subjected to the fire test method in ULC-S115, "Fire Tests of Firestop Systems", has an FT rating not less than the *fire-resistance rating* for the *fire separation*.

COMBUSTIBILITY OF SERVICE PENETRATIONS

Pipes, ducts, electrical outlet boxes, totally enclosed raceways or other similar service equipment that penetrate an assembly required to have a *fire-resistance rating* are to be *noncombustible* unless the assembly has been tested incorporating that service equipment as per Article 3.1.9.2.

EXCEPTIONS

In Noncombustible Raceways

As required by Article 3.1.9.3., optical fibre cables and electrical wires and cables in totally enclosed *noncombustible* raceways are permitted to penetrate an assembly required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required by Article 3.1.9.2.

In Nonmetallic Raceways

Totally enclosed nonmetallic raceways conforming to Article 3.1.5.20., optical fibre cables, and electrical wires and cables, single or grouped, with *combustible* insulation, jackets or sheathes that conform to the requirements of Clause 3.1.5.18.(1)(a) and that are not installed in totally enclosed *noncombustible* raceways are permitted to penetrate an assembly required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required by Article 3.1.9.2., provided the overall diameter of the single or grouped wires or cables, or the raceways is not more than 25 mm.

Single Conductor More Than 25 mm

Single conductor metal sheathed cables with *combustible* jacketing that are more than 25 mm in overall diameter are permitted by Sentence 3.1.9.3.(3) to penetrate a *fire separation* required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required by Article 3.1.9.2., provided the cables are not grouped.

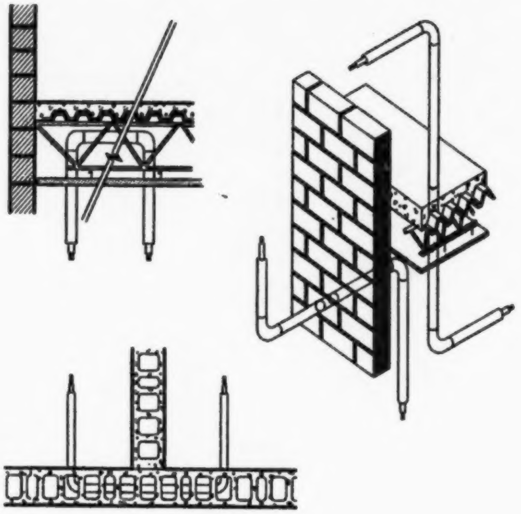


FIGURE 5-2

Combustible Raceways in Concrete Slabs

As per Article 3.1.9.3., *combustible* totally enclosed raceways which are embedded in a concrete floor slab are permitted in an assembly required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required by Article 3.1.9.2., provided the concrete cover between the raceway and the bottom of the slab is not less than 50 mm.

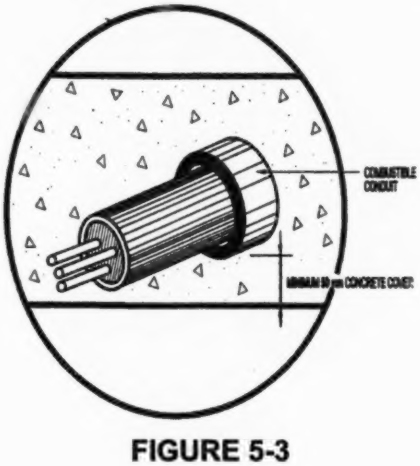


FIGURE 5-3

Combustible Outlet Boxes

Combustible outlet boxes are permitted in an assembly required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required by Article 3.1.9.2., provided the opening through the membrane into the box is not more than 0.016 m^2 as per Article 3.1.9.3.

Outlet boxes that penetrate opposite sides of a wall assembly are to be offset where necessary to maintain the integrity of the *fire separation*.

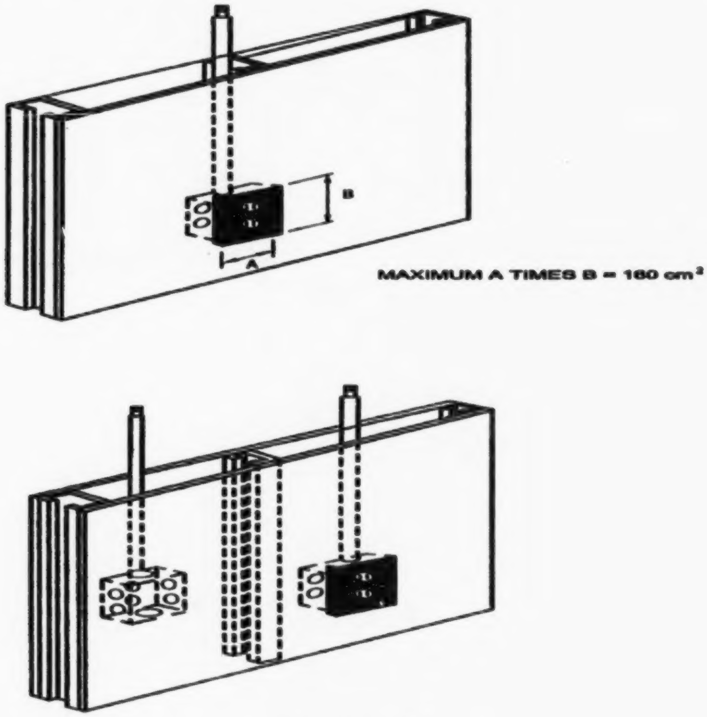


FIGURE 5-4

EXCEPTIONS

Combustible Sprinkler Piping

Combustible sprinkler piping is permitted by Article 3.1.9.4. to penetrate a *fire separation* provided the *fire compartments* on each side of the *fire separation* are *sprinklered*.

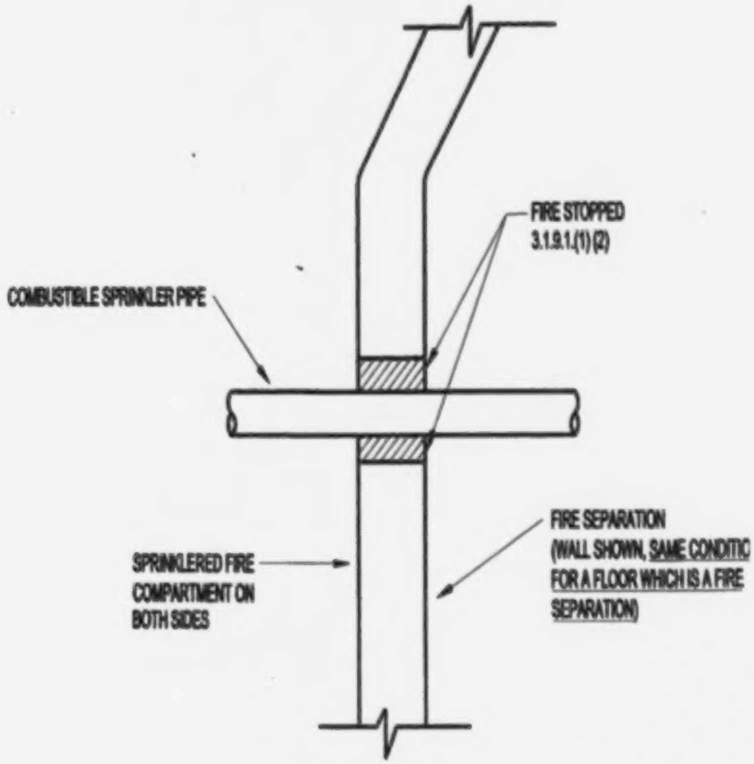

FIRE STOPPED
3.1.9.1.(1) (2)
COMBUSTIBLE SPRINKLER PIPE
SPRINKLERED FIRE COMPARTMENT ON BOTH SIDES
FIRE SEPARATION
(WALL SHOWN, SAME CONDITIC
FOR A FLOOR WHICH IS A FIRE
SEPARATION)

FIGURE 5-5

As per Article 3.1.9.4., *combustible* piping must not be used if any part of that system penetrates

- a *fire separation* required to have a *fire-resistance rating*, or
- a membrane that forms part of an assembly required to have a *fire-resistance rating*.

Exceptions

Combustible piping is permitted to penetrate a *fire separation* required to have a *fire-resistance rating* or a membrane that forms part of an assembly required to have a *fire-resistance rating*, provided

- the piping is sealed at the penetration by a fire stop system that has an F rating not less than the *fire-resistance rating* required for the *fire separation* when subjected to the fire test method in ULC-S115, "Fire

Tests of Firestop Systems", with a pressure differential of 50 Pa between the exposed and unexposed sides, with the higher pressure on the exposed side, and

- the piping is not located in a vertical shaft.

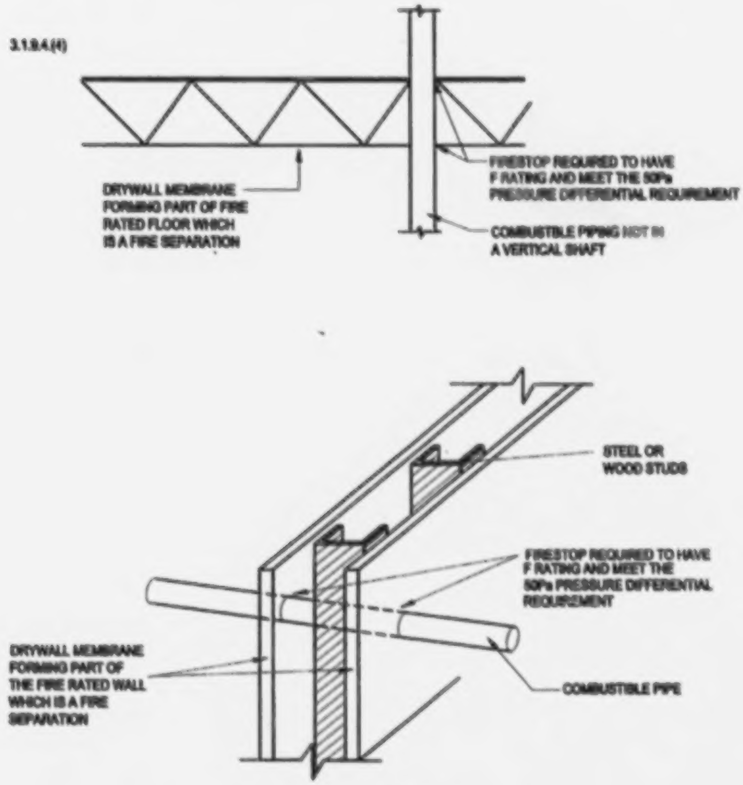

3.1.9.4.(4)
DRYWALL MEMBRANE FORMING PART OF FIRE RATED FLOOR WHICH IS A FIRE SEPARATION
FIRESTOP REQUIRED TO HAVE F RATING AND MEET THE 50Pa PRESSURE DIFFERENTIAL REQUIREMENT
COMBUSTIBLE PIPING NOT IN A VERTICAL SHAFT
STEEL OR WOOD STUDS
FIRESTOP REQUIRED TO HAVE F RATING AND MEET THE 50Pa PRESSURE DIFFERENTIAL REQUIREMENT
DRYWALL MEMBRANE FORMING PART OF THE FIRE RATED WALL WHICH IS A FIRE SEPARATION
COMBUSTIBLE PIPE

FIGURE 5-6

Combustible Drain Piping

As stated by Article 3.1.9.4., *combustible* drain piping is permitted to penetrate a horizontal *fire separation* provided it leads directly from a *noncombustible* water closet through a concrete floor slab.

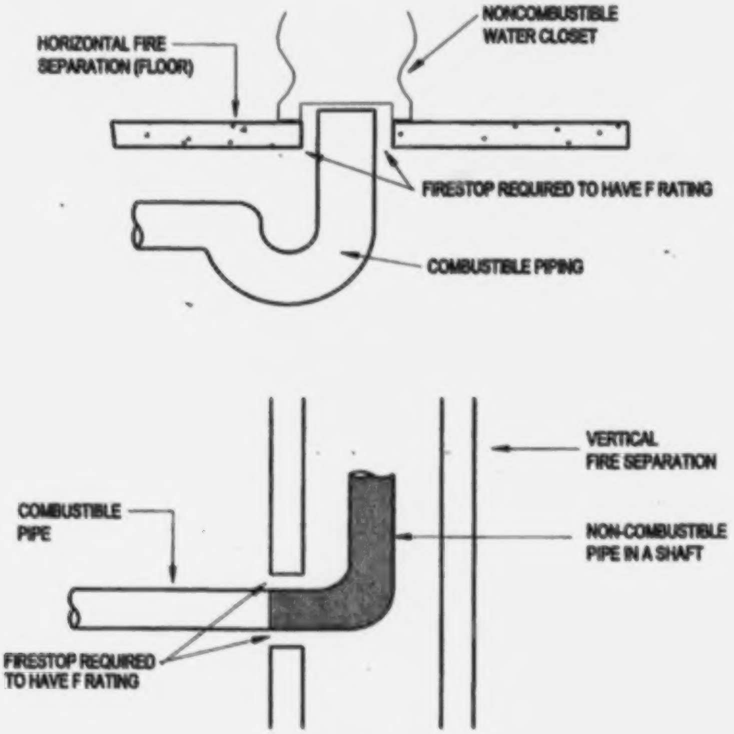

HORIZONTAL FIRE SEPARATION (FLOOR)
NONCOMBUSTIBLE WATER CLOSET
FIRESTOP REQUIRED TO HAVE F RATING
COMBUSTIBLE PIPING
VERTICAL FIRE SEPARATION
COMBUSTIBLE PIPE
NON-COMBUSTIBLE PIPE IN A SHAFT
FIRESTOP REQUIRED TO HAVE F RATING

FIGURE 5-7

Not Located in a Vertical Shaft

Combustible piping is permitted on one side of a vertical *fire separation* provided it is not located in a vertical shaft as per Article 3.1.9.4.

Sprinklered Fire Compartments

Combustible piping is permitted to penetrate a vertical or horizontal *fire separation* provided the *fire compartments* on each side of the *fire separation* are sprinklered as stated in Article 3.1.9.4.

Chlorine Gas Service Room

Combustible piping not more 25 mm in diameter containing chlorine gas is permitted by Article 3.1.9.4. to penetrate a *fire separation* between a chlorine gas *service room*, built in conjunction with a *public pool* or *public spa*, and the remainder of the *building*.

Openings through a Membrane Ceiling

As per Article 3.1.9.5., a membrane ceiling forming part of an assembly assigned a *fire-resistance rating* on the basis of the Supplementary Standard SB-2 is permitted to be penetrated by openings leading into ducts within the ceiling space provided

- the ducts are sheet steel, and
- the amount of openings and their protection conform to the requirements of the Supplementary Guidelines.

Fire stop flaps in ceiling membranes required above are to conform to CAN4-S112.2-M, "Fire Test of Ceiling Firestop Flap Assemblies".

Plenums

A ceiling assembly used as a *plenum* is to conform to 3.6.4.3.

STOP

EXAMPLE QUESTION

- *Combustible* totally enclosed raceways that are embedded in a concrete floor slab are permitted in an assembly required to have a *fire-resistance rating* under specific conditions. Describe the requirements and allowances?

Answer: ______________________________

____

____

OBC Reference ______________________________

EXERCISE #5-1

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice or search and record method.

1. *Combustible* piping is permitted to penetrate a *fire separation* required to have a *fire-resistance rating* or a membrane that forms part of an assembly required to have a *fire-resistance rating*, provided the piping is sealed at the penetration by a fire stop system that has an F rating not less than the *fire-resistance rating* required for the *fire separation* when subjected to the fire test method in ULC-S115, "Fire Tests of Firestop Systems", and two other conditions.

   Describe the two further conditions required to conform to the OBC?

Answer: ____

____

____

OBC Reference ____

2. Single conductor metal sheathed cables with *combustible* jacketing that are more than 25 mm in overall diameter are permitted to penetrate a *fire separation* required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required by Article 3.1.9.2., provided which one of the following conditions?
    - a) cables together are not more than 0.016 m^2;
    - b) cables are not grouped;
    - c) cables are not more than 50 mm;
    - d) cables are not located in a vertical shaft.

OBC Reference ______________________________

3. What are the requirements for *combustible* outlet boxes so that they may be permitted in an assembly required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing?

Answer: ______________________________

____

____

STOP

Ontario **Ministry of Municipal Affairs and Housing**

BUILDING SERVICES

PARTICIPANT'S MODULE #6

Fire Alarm and Detection Systems

JAN06

INTRODUCTION

This module covers the requirements for the design, installation, testing, and operation of *building* fire alarm systems.

OBJECTIVES

Upon completion of this module participants will be able to:

- Determine the requirement for a fire alarm system;
- Understand the concept of continuity of fire alarm system;
- Understand the types of fire alarm systems;
- Understand the requirements for installation and testing of fire alarm systems;
- Understand the types of signaling, annunciation and zone indication;
- Understand the types of fire, smoke, and heat detectors;
- Understand the concept of prevention of smoke circulation;
- Understand the concept of *building* services shutdown or control upon actuation of the fire alarm system;
- Determine when sprinklers may be used in lieu of fire detectors;
- Understand the required function of system monitoring, manual pull stations, alert and alarm signals, visual signals, and voice communication systems;
- Understand the requirements for smoke alarms.

STOP

DETERMINATION OF REQUIREMENT FOR A FIRE ALARM SYSTEM

Article 3.2.4.1. identifies the types of buildings that are required to be provided with a fire alarm system. A building that contains any of following is required to be provided with a fire alarm system:

- a *contained use area*,
- an *impeded egress zone*,
- more than 3 *storeys*, including *storeys* below the *first storey*,
- a total *occupant load* more than 300, other than in open air seating areas,
- an *occupant load* more than 150 above or below the *first storey*, other than in open air seating areas,
- a school, college, or child care facility, with an *occupant load* more than 40,
- a licensed beverage establishment or a restaurant, with an *occupant load* more than 150,
- a *medium hazard industrial occupancy* or a *low hazard industrial occupancy* with an *occupant load* more than 75 above or below the *first storey*,
- a *residential occupancy* with sleeping accommodation for more than 10 persons,
- a *high hazard industrial occupancy* with an *occupant load* more than 25,
- an *occupant load* more than 300 below an open air seating area,
- an *interconnected floor space* required to conform to Articles 3.2.8.3. to 3.2.8.11,
- a *care and treatment occupancy* for more than 10 persons receiving care or treatment, or
- *a care occupancy for more than 10 persons receiving care.*

Exceptions

Sentence 3.2.4.1.(3) offers an exception to the requirement for a fire alarm system for buildings if each *dwelling unit* has direct access to an exterior *exit* facility leading to ground level and;

- in which not more than 4 *dwelling units* share a common *means of egress*, or

- which is not more than 3 *storeys* in *building height*.

A fire alarm system is not required in a *hotel* 3 *storeys* or less in *building height* provided each *suite* has direct access to an exterior *exit* facility leading to ground level as per Sentence 3.2.4.1.(4).

Another exemption is contained in Sentence 3.2.4.1.(5) where a fire alarm system is not required in an *open-air storage garage* of

- *noncombustible construction*,
- not more than 22 m high,
- not more that 10000 m^2 in *building area,*
- conforming to Article 3.2.2.83., and
- provided there are no other *occupancies* in the *building*.

CONTINUITY OF FIRE ALARM SYSTEM

Article 3.2.4.2. defines conditions for continuity of a fire alarm system.

If there are openings through a *firewall*, other than those for piping, tubing, wiring and totally enclosed *noncombustible* raceways, the requirements Subsection 3.2.4. Fire Alarm and Detection Systems are to apply to the *floor areas* on both sides of the *firewall* as if they were in the same *building*.

If a *building* contains more than one *major occupancy* and a fire alarm system is required, a single system is to serve all *occupancies*.

If a fire alarm system is required in any portion of a *building,* it is to be installed throughout the *building*.

Exceptions for Separated Portions of Buildings

Sentence 3.2.4.2.(4) offers an exception to the requirement for a continuous fire alarm system for each portion of a *building* not more than 3 *storeys* in *building height*, in which a vertical *fire separation* having a *fire-resistance rating* not less than 1 h separates the portion from the remainder of the *building* as if it were a separate *building*

No openings through the *fire separation*, other than those for piping, tubing, wiring and totally enclosed *noncombustible* raceways are allowed.

The permission to consider separated portions of a *building* as separate *buildings* does not apply to *service rooms* and storage rooms as the "separated" portions of the *building*.

STOP

EXAMPLE QUESTION

- Which one of the following, contained in a *building*, does NOT require a fire alarm system?
    - a) an *impeded egress zone*
    - b) child care facility, *occupant load* of 40
    - c) a licensed beverage establishment *occupant load* 250,
    - d) a *residential occupancy* with sleeping accommodation for 12 persons

OBC Reference ______________________________

EXERCISE #6-1

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. A fire alarm system is NOT required in a *hotel* 3 *storeys* in *building height* with sleeping accommodations for 12 people, provided which one of the following design conditions exists?

   a) each *dwelling unit* has direct access to an exterior *exit* facility leading to ground level
   b) contains a restaurant, with an *occupant load* less than 150
   c) not more than 4 *dwelling units* share a common *means of egress*
   d) each *suite* has direct access to an exterior *exit* facility leading to ground level

OBC Reference ______________________________

2. Which one of the following, contained in a *building,* does NOT require a fire alarm system?
   a) a *high hazard industrial occupancy, occupant load* 35
   b) a three *storey low hazard industrial occupancy* with an *occupant load* of 30 per *storey*
   c) a *care occupancy* for 12 persons receiving care
   d) a school, *occupant load* 50

OBC Reference ______________________________

3. Requirements regarding fire alarm systems are permitted to be applied to each separated portion of a *building*. Which one of the following is NOT permitted as, or in, a separated portion of a *building*?
   a) height 3 *storeys* or less
   b) storage rooms as the "separated" portion
   c) *fire separation* having a *fire-resistance rating* not less than 1 h
   d) totally enclosed *noncombustible* raceways

OBC Reference ______________________________

4. An *open-air storage garage* may not require a fire alarm system. Which one of the following conditions is required to permit occupancy and operation of the building without the installation of a fire alarm system?
   - a) *noncombustible construction*
   - b) *building height* of 30 m
   - c) *building area* of 15000 m^2
   - d) *personal services occupancy* on the first *storey*

OBC Reference ______________________________

STOP

TYPES OF FIRE ALARM SYSTEMS

Article 3.2.4.3. defines the types of fire alarm systems depending on occupancy and building size.

A **single stage system** is required:

- in a Group F, Division 1 *occupancy*,
- in elementary and secondary schools, except for a special needs facility

A **two-stage system** is required:

- in a Group B occupancy other than a building 3 storeys or less in building height which contains a Group B, Division 3 occupancy,

In all other cases, a single or two- stage system is permitted.

DESCRIPTION OF FIRE ALARM SYSTEMS

Definitions review:

Alert signal means an audible signal to advise designated persons of a fire emergency.

Alarm signal means an audible signal transmitted throughout a zone or zones or throughout a *building* to advise occupants that a fire emergency exists.

Single Stage System

Sentence 3.2.4.4.(1) describes the required operation of a single stage fire alarm system. Upon the operation of any manual pull station or *fire detector*, an *alarm signal* is required to sound on all audible signal devices in the system.

Two Stage Systems

Sentence 3.2.4.4.(2) describes the required operation of a two stage fire alarm system. A 2 stage fire alarm system is to:

- cause an *alert signal* to sound upon the operation of any manual pull station or *fire detector*,
- automatically cause an *alarm signal* to sound if the *alert signal* is not acknowledged within 5 min of its initiation (except for a Group B, Division 2 *occupancy* – hospitals, long term care, homes for the aged or developmentally handicapped)
- have each manual pull station equipped so that the use of a key or other similar device causes an *alarm signal* to sound and continue to sound upon the removal of the key or similar device from the manual pull station, and
- in a *building* containing a hotel cause an *alarm signal* to sound in the initiating fire zone in the *hotel* and cause an *alert signal* to sound throughout the *hotel* and the *building* as necessary to alert *hotel* staff.

Zone Coding

As permitted by 3.2.4.4.(3), a two stage fire alarm system is permitted to be zone coded so that, upon the operation of any manual pull station or *fire detector*

- a coded *alert signal* is sounded indicating the zone of alarm initiation,
- the coded *alert signal* is repeated in its entirety not less than 4 times, and

- a continuous *alert signal* is sounded upon completion of the coded signals.

If a second manual pull station or *fire detector* is operated in a zone other than that for the first *alert signal,* the coded *alert signal* for the first zone is to be completed before the coded *alert signal* for the second zone is repeated (not less than 4 times).

INSTALLATION AND TESTING OF FIRE ALARM SYSTEMS

Fire alarm and voice communication systems are to be installed in conformance with CAN/ULC-S524, "Installation of Fire Alarm Systems". (Article 3.2.4.5.) A fire alarm system is to be tested in conformance with CAN/ULC-S537, "Verification of Fire Alarm Systems", to ensure satisfactory operation.

ELECTRICAL SUPERVISION

In accordance with Article 3.2.4.9., electrical supervision is to be provided for a fire alarm system. If a fire alarm system is installed in a *building*, Sentence 3.2.4.9.(2) requires that an automatic sprinkler system is to be electrically supervised to indicate a supervisory signal on the *building* fire alarm system annunciator panel for each of the following:

- movement of a valve handle that controls the supply of water to sprinklers,
- loss of excess water pressure required to prevent false alarms in a wet pipe system,
- loss of air pressure in a dry pipe system,
- loss of air pressure in a pressure tank,
- a significant change in water level in any water storage container used for fire fighting purposes,
- loss of power to any automatically starting fire pump, and
- a temperature approaching the freezing point in any dry pipe valve enclosure or water storage container used for fire fighting purposes.

STOP

EXAMPLE QUESTION

- In a 2 stage fire alarm system a manual pull station is to be equipped so that the use of a key or other similar device that will?
  - a) silence the system
  - b) initiate zone coding
  - c) initiate an *alarm signal*
  - d) reset the system to *alert signal*

OBC Reference ______________________________

EXERCISE #6-2

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. Which one of the following *occupancies* requires the use of a single stage fire alarm system?
   - a) Group B *occupancy*
   - b) Group F, Division 1
   - c) *dwelling units*
   - d) for a special needs facility

OBC Reference ______________________________

2. The purpose of an *alert signal* is to?
   - a) advise occupants that a fire emergency exists
   - b) acknowledge an *alarm signal*
   - c) advise designated persons of a fire emergency
   - d) perform zone coding

OBC Reference ______________________________

3. The purpose of zone coding is to?
    a) provide a continuous *alert signal*
    b) repeat indication in 4 zones
    c) initiate an *alarm signal* after 4 min
    d) indicate the zone of alarm initiation,

OBC Reference ______________________________

4. For electrical supervision of an automatic sprinkler system, which one of the following is NOT required to be supervised?
    a) loss of excess water pressure required to prevent false alarms in a wet pipe system,
    b) loss of air pressure in a dry pipe system
    c) loss of power to the excess pressure pump
    d) movement of a valve handle that controls the supply of water to sprinklers

OBC Reference ______________________________

STOP

FIRE DETECTORS

Article 3.2.4.10. describes the requirements for *fire detectors* to be installed where a fire alarm system is required. Where a fire detector is required, either a heat detector or smoke detectors is acceptable.

Fire detectors are to be installed in

- storage rooms not within *dwelling units,*
- service rooms not within *dwelling units,*
- janitors' rooms,
- rooms in which hazardous substances are to be used or stored,

- elevator and dumbwaiter shafts,
- a laundry room in a *building* of *residential occupancy*, but not one within a *dwelling unit*, and
- *hazardous classrooms* and change rooms in elementary and secondary schools.

SPRINKLERS IN LIEU OF FIRE DETECTORS

Because sprinklers act as heat detectors, where a *fire detector* is otherwise required to be installed, they are not required within a *floor area* if the *floor area* is *sprinklered* and the sprinkler system is electrically supervised. (Article 3.2.4.15)

SMOKE DETECTORS

In some cases for a required fire alarm system, *smoke detectors* are specifically required to be installed. As per Sentence 3.2.4.11.(1), smoke detectors are required to be installed in

- each sleeping room and each corridor serving as part of a *means of egress* from sleeping rooms in portions of a *building* classified as Group B *major occupancy,*
- each room in a *contained use area* and corridors serving those rooms,
- each corridor in portions of a *building* classified as Group A, Division 1 *major occupancy,*
- each *public corridor* in portions of a *building* classified as Group C *major occupancy,*
- each *exit* stair shaft, and
- each corridor serving classrooms in elementary and secondary schools.

HEAT DETECTORS

In some cases for a required fire alarm system, *heat detectors* are specifically required to be installed. As per Sentence 3.2.4.11.(2), for a required fire alarm system *heat detectors* are to be installed in

- every room in portions of *buildings* classified as Group A, Division 1,
- in every *suite*, and every room not located within a *suite*, in portions of *buildings* classified as Group C *major occupancy* and more than 3 *storeys* in *building height* (except in a *hotel*), and
- in a *floor area* containing a *hotel*, in every room in a *suite* and in every room not located in a *suite* other than washrooms within a *suite*, saunas, refrigerated areas and swimming pools.

SPRINKLERS IN LIEU OF HEAT DETECTORS

Because sprinklers act as heat detectors, where a *heat detector* is otherwise required to be installed, they are not requried within a *floor area* if the *floor area* is *sprinklered* and the sprinkler system is electrically supervised. (Article 3.2.4.15)

SYSTEM MONITORING

As per Article 3.2.4.16., an automatic sprinkler system is to be equipped with waterflow detecting devices and, if an annunciator is required by Article 3.2.4.8., are to be installed so that each device serves

- not more than one *storey*, and
- an area on each *storey* that is not more than the system area limits as specified in NFPA 13, "Standard for the Installation of Sprinkler Systems".

Waterflow detecting devices are to be connected to initiate an *alert signal* or an *alarm signal* on the fire alarm system.

MANUAL PULL STATIONS

Article 3.2.4.17. prescribes the requirements for installation of manual pull stations. Generally, a manual pull station is to be installed near the principal entrance to the *building* and near every required *exit*.

Exceptions

Sentences 3.2.4.17.(2) and (3) identified exceptions to the requirements for a manual pull station.

A manual pull station is not required at an exterior egress doorway from a *suite* (that does not lead to an interior shared *means of egress* in a *hotel)*

- where each *suite* is served by an exterior *exit* facility leading directly to ground level,
- the *building* is not more than 3 *storeys* in *building height*, and
- the *building* is *sprinklered*,

However, in the above case, manual pull stations are to be installed near doorways leading from shared interior corridors to the exterior. (Sentence 3.2.4.17.(4))

A manual pull station is not required at an exterior egress doorway from a *dwelling unit* (that does not lead to an interior shared *means of egress)*

- in a *building* not more than 3 *storeys* in *building height* containing only *dwelling units*,
- where each *dwelling unit* is served by an exterior *exit* facility leading directly to ground level, and
- the *building* is *sprinklered*,

However, manual pull stations are to be installed near doorways leading from shared interior corridors to the exterior in the above cases. (Sentence 3.2.4.17.(4))

Hotel

Sentence 3.2.4.17.(5) requires the installation of a manual pull station in the main reception area serving the *hotel* in a *building* containing a *hotel*.

Apartment Buildings

Except as described above in Group C apartment *buildings*, if a pull station is not installed on a *floor area*

- a manual pull station is to be installed in every *dwelling unit* in the *floor area* near each egress door leading from the *dwelling unit*,
- *smoke detectors* are to be installed in the *floor area* in *public corridors* and stairwells, and
- *fire detectors* are to be installed in the *floor area* in all common public areas and in rooms not located within *dwelling units*.

In *floor areas* where the manual pull stations are located in *dwelling units*, a legible sign stating FIRE ALARM PULL STATIONS LOCATED IN APARTMENT UNITS is to be posted near every *exit* in a *public corridor*.

Group B

Key switch activated pull stations are permitted in an *impeded egress zone* and a *contained use area* in Group B, Division 1 and Division 2 *occupancies*.

SMOKE ALARMS

Sentences 3.2.4.21.(1) to (3) prescribes *smoke alarms* to conform to CAN/ULC-S531, "Smoke Alarms". These smoke detectors are to be installed in each *dwelling unit* and, except for *care or detention occupancies* required to have a fire alarm system, in each sleeping room not within a *dwelling unit*.

At least one *smoke alarm* is to be installed on each *storey* and *mezzanine* of a *dwelling unit*.

On any *storey* of a *dwelling unit* containing sleeping rooms, a *smoke alarm* is to be installed in a location between the sleeping rooms and the remainder of the *storey*, and if the sleeping rooms are served by a hallway, the *smoke alarm* is to be located in the hallway.

Smoke Alarms – Installation

Sentence 3.2.4.21.(4) to (9) describes the details for installation of smoke detectors including the following:

- A smoke alarm is to be installed on or near the ceiling.
- A smoke alarm is to be installed with permanent connections to an electrical circuit and must have no disconnect switches between the overcurrent device and the smoke alarm.
- If more than one smoke alarm is required in a dwelling unit, the smoke alarms are to be wired so that the actuation of one smoke alarm will cause all smoke alarms within the dwelling unit to sound.
- A smoke alarm is to be installed in conformance with CAN/ULC-S553, "Installation of Smoke Alarms".

As per Sentence 3.2.4.21.(8), for smoke alarms installed within dwelling units, a manually operated device is permitted to be incorporated within the circuitry of a *smoke alarm* installed in a *dwelling unit* so that

- it will silence the signal emitted by the *smoke alarm* for a period of not more than 10 min,
- after which the *smoke alarm* will reset and again sound the alarm if the level of smoke in the vicinity is sufficient to reactuate the *smoke alarm*.

STOP

EXAMPLE QUESTION

- A secondary school has a *building area* of 1000 m^2 and is *sprinklered*. For the provision of fire detectors, which one following best describes the requirements of the OBC?
    a) installed in *hazardous classrooms*
    b) installed in storage rooms
    c) installed in janitors' rooms
    d) installed in none, or any, of these rooms

OBC Reference ______________________________

EXERCISE #6-3

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. For a required fire alarm system *smoke detectors* are to be installed in which one of the following?
    a) each *exit* stair shaft
    b) each *public corridor* in portions of a *building* classified as Group E *major occupancy*
    c) each sleeping room and each corridor serving as part of a *means of egress* from sleeping rooms in portions of a *building* classified as Group C *major occupancy*
    d) each classroom in elementary and secondary schools

OBC Reference ______________________________

2. Which one of the following best describes where manual pull stations are to be installed?
    a) near the principal entrance to a *building*
    b) near every key switch activated pull station
    c) near every required *exit*
    d) near the principal entrance to a *building* and near every required *exit*

OBC Reference ______________________________

3. A smoke alarm is required in which one of the following?
    a) a sleeping room within a *dwelling unit*
    b) a *suite* in a *hotel*
    c) a sleeping room in *care or detention occupancies* required to have a fire alarm
    d) a furnace room of a *dwelling unit*

OBC Reference ______________________

4. Which one of the following is NOT an installation requirement for smoke alarm?
    a) to be installed on or near the ceiling
    b) have a disconnect switch between the overcurrent device and the *smoke alarm*
    c) permanent connections to an electrical circuit
    d) to be wired so that the actuation of one *smoke alarm* will cause all *smoke alarms* to sound

OBC Reference ______________________

ANNUNCIATOR AND ZONE INDICATION

An annunciator is to be installed in close proximity to a *building* entrance that faces a *street* or an access route required for fire department vehicles.

The annunciator is to have separate zone indication of the actuation of the alarm initiating devices in each

- *floor area* so that in a *building* that is not *sprinklered*, the area of coverage for each zone is neither more than one *storey*, nor 2000 m^2,

- *floor area* so that in a *building* that is *sprinklered*, the area of coverage for each zone is neither more than one *storey* nor the system area limits as specified in NFPA 13, "Standard for the Installation of Sprinkler Systems",

- shaft required to be equipped with *smoke detectors*,
- air handling system required to be equipped with *smoke detectors*,
- *contained use area*,
- *impeded egress zone*,
- *fire compartment* required in a hospital or nursing home,
- *fire compartment* required to be separated by vertical *fire separations* having a *fire-resistance rating* not less than 2 h, other than *dwelling units* described in Subsection 3.3.4.

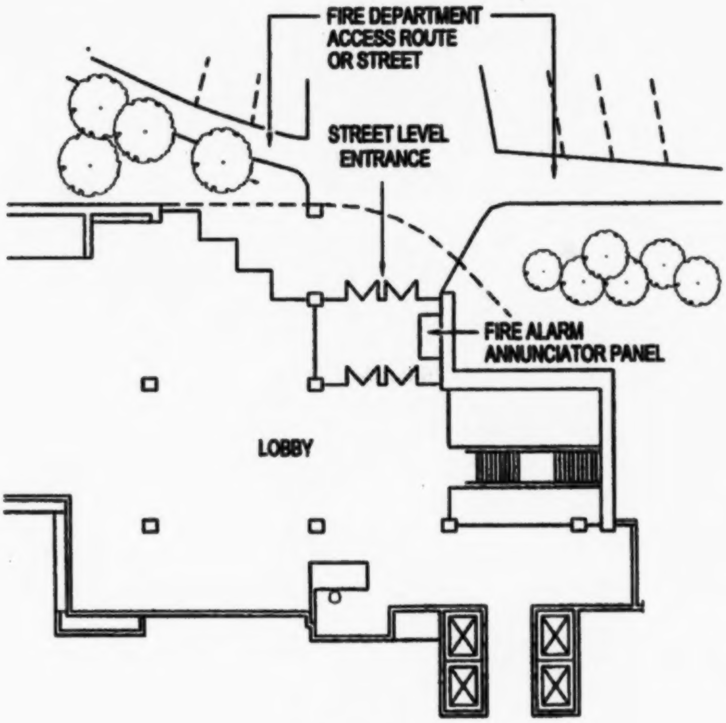

FIRE DEPARTMENT ACCESS ROUTE OR STREET
STREET LEVEL ENTRANCE
FIRE ALARM ANNUNCIATOR PANEL
LOBBY

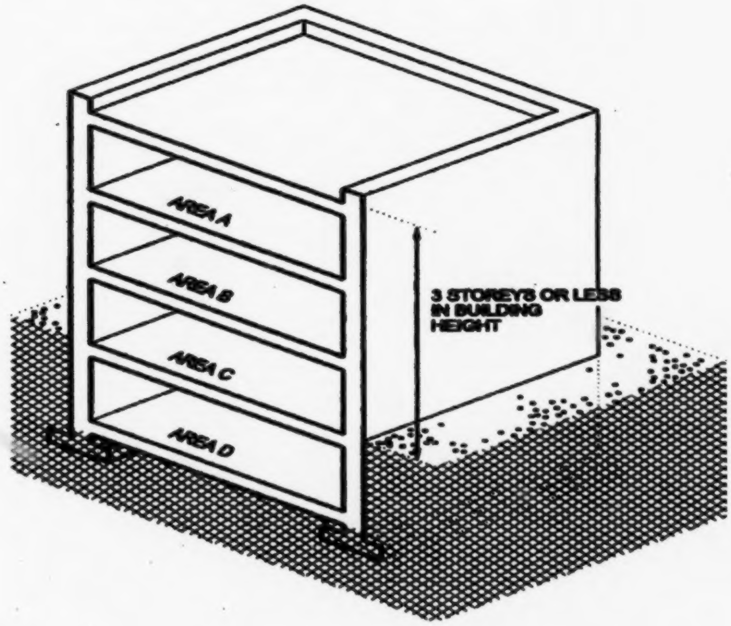
FIGURE 6-1

Exceptions

An annunciator need not be provided for a fire alarm system if not more than one zone indicator is required.

If an annunciator is not installed as part of a fire alarm system, a visual and audible trouble signal device is to be provided inside the main entrance of the *building*.

The requirements for an annunciator are waived in a *building* that has an aggregate area for all *storeys* of not more than 2000 m^2 and that is not more than 3 *storeys* in *building height*.



AN ANNUNCIATOR IS NOT REQUIRED IF AREAS A + B + C + D DO NOT EXCEED 2 000 m^2

FIGURE 6-2

The area limits of 2000 m^2 for each indication zone (not *sprinklered building*) are waived for an interior undivided open space used as an arena, a rink or a swimming pool, provided other spaces in the *building* that are separated from the open space are individually zoned as required.

Main Control Unit and Signals

Whether an annuciator is present or not, all fire alarm systems are to include a main control unit. All signal and supervision circuits are to report, either directly or by means of transponders, and each annunciator or trouble signal device is to be connected to the main control unit.

In a *building* containing a *hotel* in which a trouble signal sounding device has a silencing switch, a trouble light is to be installed in the main reception area serving the *hotel*, or another continually-supervised location.

In a nursing home, a remote audiovisual fire alarm trouble signal is to be located at the main nursing station.

SILENCING OF ALARM SIGNALS

A fire alarm system is to be designed so that when an *alarm signal* is actuated, it cannot be silenced automatically before a period of time has elapsed that is not less than

- 5 min for a *building* not required to be equipped with an annunciator, and
- 20 min for any other *building*.

A fire alarm system must not incorporate manual silencing switches other than those installed inside the fire alarm control unit.

Exceptions

In a *care and treatment occupancy* an *alert signal* is permitted to be silenced automatically after 1 min.

A fire alarm audible signal device located within a *dwelling unit* is required to incorporate a means that enables the device to be silenced for a period of not more than 10 min, after which the device is to restore to normal operation.

As per Sentences 3.2.4.22.(2) and (3) where a voice communication system is required, it is to include provision for silencing the *alert signal* and/or *alarm signal* in a fire alarm system, when voice messages are being transmitted, however only after a minimum 30 s for single stage fire alarm systems. For two stage fire alarm systems, voice messages are permitted to be transmitted after the alert signal has sounded for not less than 10 s in hospitals having 24 hour staff supervision and 30 s for all other occupancies.

SIGNALS TO FIRE DEPARTMENT

A provided single stage system fire alarm system is to be designed to notify the fire department (in conformance with listed methods) that an *alarm signal* has been initiated in

- a Group A *occupancy* having an *occupant load* more than 300,
- a Group B *occupancy*,
- a Group F, Division 1 *occupancy*,
- a *building* regulated by the provisions of Subsection 3.2.6. Additional Requirements for High Buildings, or
- a *building* containing *interconnected floor space* required to conform to Articles 3.2.8.3. to 3.2.8.11. (of Subsection Mezzanines and Openings through Floor Assemblies)

If a fire alarm system is installed, an automatic sprinkler system is to be designed to notify the fire department (in conformance with listed methods) that a waterflow switch has been actuated.

If a fire alarm system is required to be installed and a 2 stage system is provided, the system is to be designed to notify the fire department (in conformance with listed methods) that an *alert signal* has been initiated.

Listed Methods

Signals to the fire department are to be by way of

- an independent central station conforming to CAN/ULC-S561 "Installation and Services for Fire Signal Receiving Centres and Stations" ,
- the municipal fire alarm system.

Exceptions

If a single stage fire alarm system has been installed that does not require provision to transmit a signal to the fire department, a legible notice, that is not easily removed, is to

- be affixed to the wall near each manual pull station,
- with wording that the fire department is to be notified in the event of a fire emergency and
- includes the emergency telephone number for the municipality or the telephone number of the fire department.

PREVENTION OF SMOKE CIRCULATION

If a fire alarm system is installed, an air handling system is to be designed to prevent the circulation of smoke upon a signal from a duct-type smoke detector if the air handling system

- serves more than one *storey*,

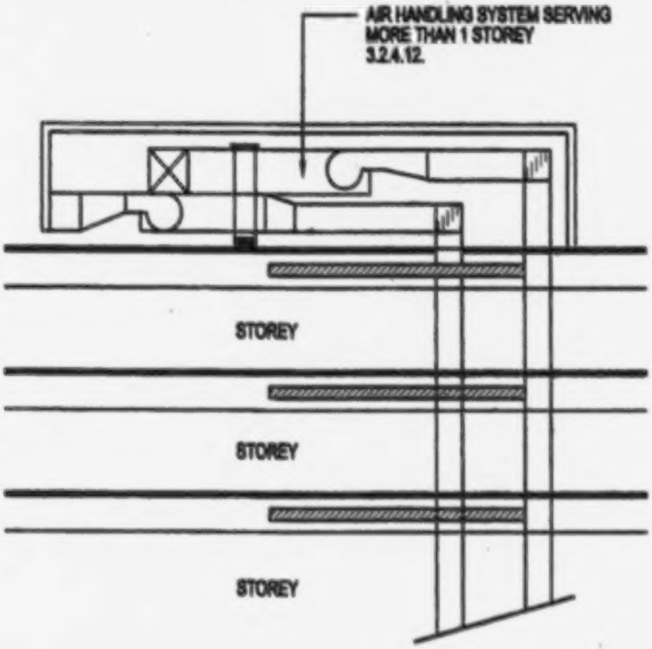


FIGURE 6-3

- serves more than one *suite* in a *storey*,
- serves more than one *fire compartment* in a *floor area* containing patients' or residents' sleeping rooms in a hospital or nursing home (required by Sentence 3.3.3.5.(2). of Subsection Care or Detention Occupancy), or
- is not provided with *fire dampers* as permitted by Sentence 3.1.8.8.(8).

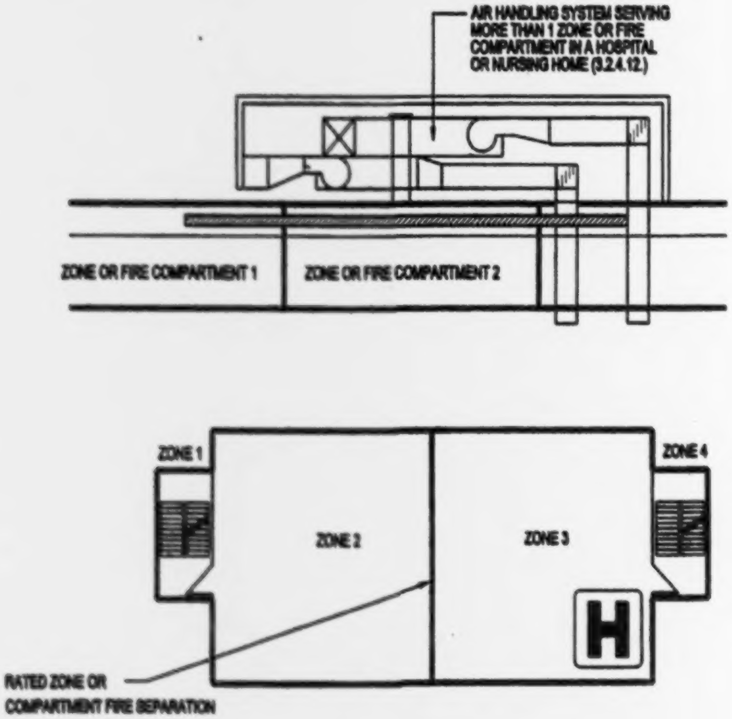

AIR HANDLING SYSTEM SERVING MORE THAN 1 ZONE OR FIRE COMPARTMENT IN A HOSPITAL OR NURSING HOME (3.2.4.12.)
ZONE OR FIRE COMPARTMENT 1
ZONE OR FIRE COMPARTMENT 2
ZONE 1
ZONE 4
ZONE 2
ZONE 3
H
RATED ZONE OR COMPARTMENT FIRE SEPARATION

FIGURE 6-4

VACUUM CLEANING SYSTEM SHUTDOWN

A central vacuum cleaning system in a *building* equipped with a fire alarm system is to be designed to shut down upon actuation of the fire alarm system.

ELEVATOR EMERGENCY RETURN

In a *building* having elevators equipped with an automatic emergency recall feature, *smoke detectors* are to be installed in the elevator lobbies on the recall level so that when these *smoke detectors* are actuated, the elevators will automatically return directly to an alternate floor level.

Smoke detectors required above are to be designed as part of the *building* fire alarm system.

Only elevators that serve *storeys* above the *first storey* require this provision.

The alternate floor recall feature is not required if the *floor area* containing the recall level is *sprinklered*.

STOP

EXAMPLE QUESTION

- An annunciator is to have separate zone indication of the actuation of the alarm initiating devices in each zone. For a *medium hazard industrial occupancy*, *building area* 4000 m^2 and *sprinklered*, which one of the following determines the zone size?
    - a) each zone is neither more than one *storey*, nor 2000 m^2
    - b) each *contained use area*
    - c) each *fire separation*
    - d) each zone is neither more than one *storey* nor more than the system area limits as specified in NFPA 13

OBC Reference ______________________________

EXERCISE #6-4

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. All fire alarm systems are to include which one of the following?
   - a) an annunciator
   - b) 2 stage capability
   - c) a main control unit
   - d) key switch activated pull stations

OBC Reference ______________________________

2. A fire alarm system, without a voice communication system, in a *care and treatment occupancy* is designed so that when an *alert signal* is actuated, may be silenced automatically after which one of the following duration times?
   - a) 20 min
   - b) 5 min
   - c) 1 min
   - d) 2 min

OBC Reference ______________________________

3. A provided single stage system fire alarm system is to notify the fire department (in conformance with listed methods) that an *alarm signal* has been initiated in which one of the following
   - a) a Group F, Division 1 *occupancy*
   - b) a Group A *occupancy* having an *occupant load* less than 300
   - c) a Group D *occupancy*
   - d) a pressure switch

OBC Reference ______________________________

4. In a *building* having elevators equipped with an automatic emergency recall feature, which one of the following arrangements permits the elevators to automatically return directly to their recall floor under all circumstances?
    a) *smoke alarms* in the recall floor area
    b) *fire detectors* in the recall floor lobby
    c) *smoke detectors* in the recall floor lobby
    d) *sprinklers* in the recall floor area

OBC Reference ______________________

ALERT AND ALARM SIGNALS

In a 2 stage fire alarm system, the same audible signal devices are permitted to be used to sound the *alert signals* and the *alarm signals*.

If audible signal devices with voice reproduction capabilities are intended for paging and similar voice message use, other than during a fire emergency, they are to be installed so that *alert signals* and *alarm signals* take priority over all other signals.

Audible signal devices forming part of a fire alarm or voice communication system must not be used for playing music or background noise.

Visual Signal Locations

As per Sentence 3.2.4.18.(4), in a *building* or portion intended for use primarily by persons with hearing impairment, visual signal devices are to be installed in addition to audible signal devices.

Visual signals are also required in the following locations:

- in a public corridor serving a Group A, B, D or E occupancy
- in a corridor used by the public and in a floor area or part thereof where the public may congregate in a Group A occupancy
- in not less than 10% of suites in a hotel or motel

Visual signal devices are permitted to be installed in lieu of audible signal devices in the compartments containing rooms such as operating rooms, recovery rooms, delivery rooms, intensive care units and critical care units.

Regardless of the requirements of Sentence 3.2.4.18.(4), visual signals are not required in classrooms, and in Group B, Division 3 occupancies that contain sleeping accommodations for not more than 10 persons and not more than 6 persons require assistance in evacuation in case of an emergency.

AUDIBILITY OF ALARM SYSTEMS

Audible signal devices forming part of a fire alarm system are to be installed in a *building* so that *alert signals* and *alarm signals* are clearly audible throughout the *floor area* in which they are installed. Exception: Visual signal devices installed in lieu of audible signal devices.

The temporal pattern of an *alarm signal* is to conform to the temporal pattern defined in Clause 4.2 of International Standard ISO 8201, "Acoustics — Audible Emergency Evacuation Signal".

The signals from *smoke alarms* and the patterns of *alert signals* are to be sufficiently different from the signals or patterns of *alarm signals* that there is no possibility of confusion.

Sound Pressure Levels

In all normally occupied spaces, the fire *alarm signal* sound pressure level

- must be not more than 100 dBA when measured at a distance of 3 m from the device, or
- is permitted to be more than 100 dBA provided the sound pressure level measured 2000 mm above the floor level is not more than 100 dBA.

The sound pressure level in a sleeping room from a fire alarm audible signal device must be not less than 75 dBA in a *building* of *residential occupancy* when any intervening doors between the device and the sleeping room are closed.

The sound pressure level from a fire alarm audible signal device in a *floor area* used for *occupancies* other than *residential occupancies* must be not less than 10 dBA above the ambient noise level, but with a minimum value not less than 65 dBA.

Fire alarm audible signal devices are to be supplemented by visual signal devices in any *floor area* in which

- the ambient noise level is more than 87 dBA, or
- the occupants of the *floor area* use ear protective devices, are located within an audiometric booth, or are located within sound insulated enclosures.

Fire alarm audible signal devices are to be supplemented by visual signal devices in an *assembly occupancy* in which music and other sounds associated with performances could exceed 100 dBA.

Fire alarm audible signal devices are to be installed in a *service space* in which facilities are included to permit a person to enter and to undertake maintenance and other operations pertaining to *building* services.

Dwelling Units and Suites

A fire alarm audible signal device located within a *dwelling unit* is to incorporate a means that enables the device to be silenced for a period of not more than 10 min, after which the device is to restore to normal operation.

A fire alarm audible signal device located within a *dwelling unit* or a *suite* of *residential occupancy* is to be connected to the fire alarm system in a manner that disconnection or damage to the device will not interfere with the ability of devices in other *dwelling units*, *public corridors*, or *suites* to sound an alarm.

VISUAL SIGNALS

Visual signal devices are to be installed so that the signal from at least one device is visible throughout the *floor area* or portion of the *floor area* in which they are installed.

Visual signal devices in compartments containing rooms such as operating rooms, recovery rooms, delivery rooms, intensive care units and critical care units are to be installed so that the signal from not less than one device is visible throughout the compartment in which they are installed.

VOICE COMMUNICATION SYSTEMS

A required voice communication system is to consist of

- a 2-way communication system in each *floor area*, with connections to the central alarm and control facility and to the mechanical control centre, and
- loudspeakers operated from the central alarm and control facility which are designed and located so as to be audible and the messages intelligible in all parts of the *building* (except elevator cars).

The 2-way communication system referred to above is to installed so that emergency telephones are located in each *floor area* near *exit* stair shafts.

A voice communication system is to include provision for silencing the *alarm signal* in a single stage fire alarm system when voice messages are being transmitted, but only after the *alarm signal* has sounded initially for not less than

- 30 s in all *occupancies*.

A voice communication system is to include provision for silencing the *alert signal* and the *alarm signal* in a 2 stage fire alarm system when voice messages are being transmitted, but only after the *alert signal* has sounded initially for not less than

- 10 s in hospitals that have supervisory personnel on duty for 24 hours each day, or
- 30 s for all other *occupancies*.

Zone Selectivity

A voice communication system is to be designed so that the *alarm signal* can be transmitted selectively to any zone or zones while maintaining an *alert signal* or selectively transmitting voice messages to any zone or zones in the *building*.

EXAMPLE QUESTION

- Which one of the following is the minimum required sound pressure level from a fire alarm audible signal device in a *floor area* used for *occupancies* other than *residential occupancies*.
    - a) 10 dBA above an ambient noise level of 56 dBA
    - b) 75 dBA
    - c) 65 dBA
    - d) 87 dBA

OBC Reference ______________________________

EXERCISE #6-5

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. Which one of the following uses is NOT permitted for audible signal devices forming part of a fire alarm or voice communication system?
    a) *alert signals*
    b) paging signals
    c) noise suppression signals
    d) *alarm signals*

OBC Reference ______________________________

2. Which one of the following is a requirement of a fire alarm system in a *suite* of *residential occupancy* if a fire alarm audible signal device is disconnected or damage?
    a) initiate *alarm signal*
    b) system to disable device and all others on circuit
    c) no interference with other devices
    d) initiate *alert signal*

OBC Reference ______________________________

3. A voice communication system is permitted to silence the *alert signal* and the *alarm signal* in a 2 stage fire alarm system when voice messages are being transmitted. Which one of the following requirements must be met prior to silencing?
    a) *alarm signal* has sounded initially for not less than 30 s in Group B, Division 2 or 3 *major occupancy*
    b) *alert signal* is repeated in its entirety not less than 4 times
    c) *alert signal* has sounded initially for not less than 300 s
    d) *alert signal* has sounded initially for not less than 30 s in an *occupancy* other than a *hospital*

OBC Reference ______________________________

4. A voice communication system is to be designed so that voice instructions can be transmitted selectively in which one of the following ways?
    a) to any non involved zone during an initial *alert signal* sounding
    b) to any zone or zones while maintaining an *alert signal* or *alarm signal* to other zones in the *building*
    c) to be intelligible in elevator cars
    d) to selectively override visual signals

OBC Reference ______________________________

STOP

Ontario **Ministry of Municipal Affairs and Housing**

BUILDING SERVICES

PARTICIPANT'S MODULE #7

Provisions for Fire Fighting

JAN06

INTRODUCTION

This module examines requirements in the OBC related to provisions for fire fighting. Location of access routes, water supply, sprinkler systems, fire department connections, and fire pumps are some of the *building* services that are included in the scope.

OBJECTIVES

Upon completion of this module participants will be able to:

- Understand the requirements for Location of Access Routes and location of Water Supply;
- Understand the requirements for Sprinklers;
- Understand the requirements for Fire Department Connections;
- Understand the requirements for Fire Pumps.

STOP

LOCATION OF ACCESS ROUTES (3.2.5.5.)

Access routes required by Article 3.2.5.4. are to be located so that the principal entrance and every access opening required by Articles 3.2.5.1. and 3.2.5.2. are located not less than 3 m and not more than 15 m from the closest portion of the access route required for fire department use, measured horizontally from the face of the *building*.

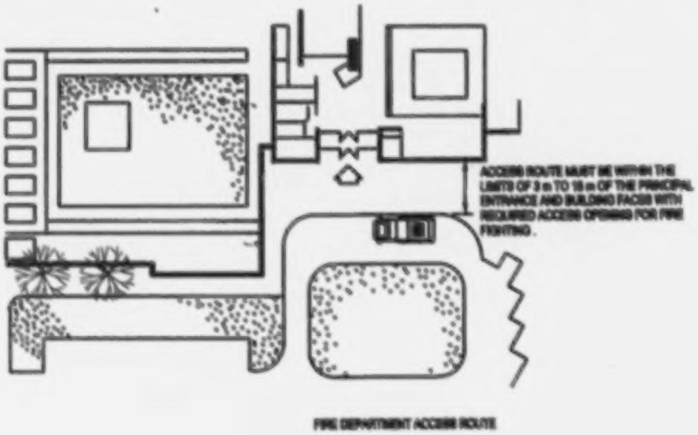

ACCESS ROUTE MUST BE WITHIN THE LIMITS OF 3 m TO 15 m OF THE PRINCIPAL ENTRANCE AND BUILDING FACES WITH REQUIRED ACCESS OPENINGS FOR FIRE FIGHTING.
FIRE DEPARTMENT ACCESS ROUTE

FIGURE 7-1

Access routes are to be provided to a *building* so that

- for a *building* provided with a fire department connection, a fire department pumper vehicle can be located adjacent to the hydrants referred to in Article 3.2.5.16.,

- for a *building* not provided with a fire department connection, a fire department pumper vehicle can be located so that the length of the access route from a hydrant to the vehicle plus the unobstructed path of travel for the firefighter from the vehicle to the *building* is not more than 90 m, and

- the unobstructed path of travel for the firefighter from the vehicle to the *building* is not more than 45 m.

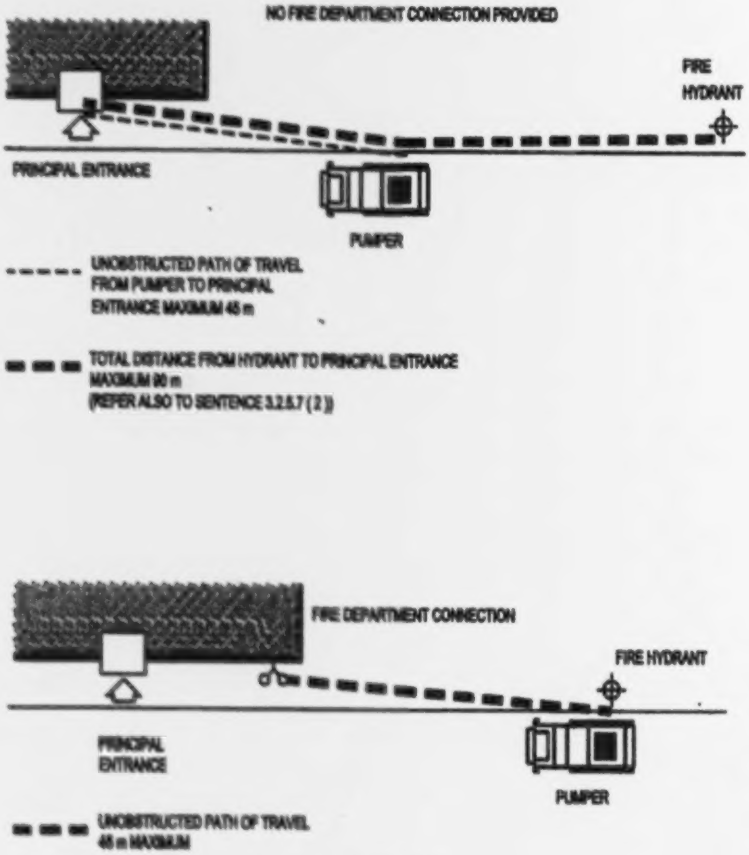
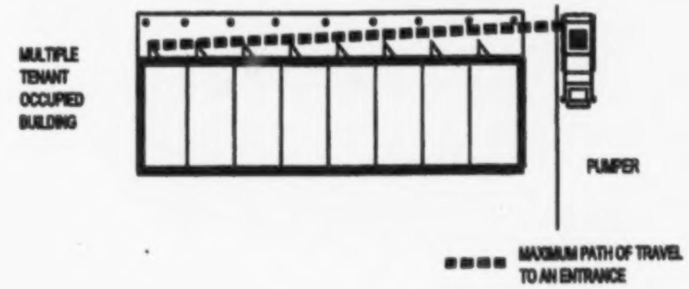

NO FIRE DEPARTMENT CONNECTION PROVIDED
FIRE HYDRANT
PRINCIPAL ENTRANCE
PUMPER
UNOBSTRUCTED PATH OF TRAVEL FROM PUMPER TO PRINCIPAL ENTRANCE MAXIMUM 45 m
TOTAL DISTANCE FROM HYDRANT TO PRINCIPAL ENTRANCE MAXIMUM 90 m (REFER ALSO TO SENTENCE 3.2.5.7 (2))
FIRE DEPARTMENT CONNECTION
FIRE HYDRANT
PRINCIPAL ENTRANCE
PUMPER
UNOBSTRUCTED PATH OF TRAVEL 45 m MAXIMUM

FIGURE 7-2

The unobstructed path of travel for the firefighter from the vehicle to the *building* is to be measured from the vehicle to the fire department connection provided for the *building*. Exception: if no fire department connection is provided, the path of travel is to be measured to the principal entrance of the *building*.

If a portion of a *building* is completely cut off from the remainder (no access to the remainder of the *building)*, then access routes are to be located so that the unobstructed path of travel from the vehicle to one entrance of each portion is not more than 45 m.


MULTIPLE
TENANT
OCCUPIED
BUILDING
PUMPER
MAXIMUM PATH OF TRAVEL
TO AN ENTRANCE

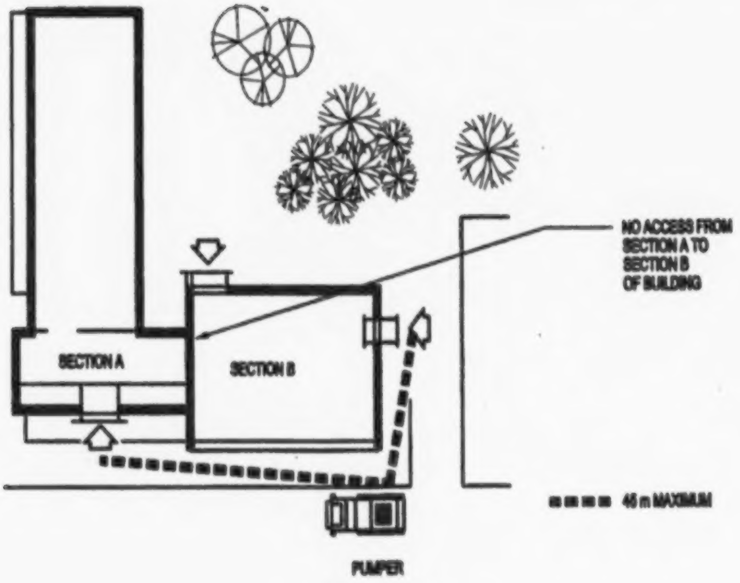

NO ACCESS FROM
SECTION A TO
SECTION B
OF BUILDING
SECTION A
SECTION B
45 m MAXIMUM
PUMPER

FIGURE 7-3

FIRE DEPARTMENT CONNECTIONS

As required by Article 3.2.5.16., the fire department connection for a standpipe system is to be located so that the distance from the fire department connection to a hydrant is not more than 45 m and is unobstructed.

The fire department connection for an automatic sprinkler system is to be located so that the distance from the fire department connection to a hydrant is not more than 45 m and is unobstructed.

The fire department connections required above are to be

- located on the outside of a *building* adjacent to a *street* or an access route, not less than 300 mm and not more than 900 mm above ground level, and
- provided with two 65 mm hose connections with female swivel hose couplings.

WATER SUPPLY

An adequate water supply for fire-fighting is to be provided for every *building* as per Article 3.2.5.7.

Hydrants are to be located within 90 m horizontally of any portion of a *building* perimeter that is required to face a *street* in Subsection 3.2.2.

FIRE PUMPS

A fire pump having a rated net head pressure greater than 280 kPa is required by Article 3.2.5.19. to be installed in accordance with the requirements of NFPA 20, "Standard for the Installation of Centrifugal Fire Pumps".

STOP

EXAMPLE QUESTION

- Read Sentence 3.2.5.5.(2) and summarize the requirements for access and required distances for a fire department pumper vehicle and a *building*?

Answer: ____

____

____

OBC Reference ____

EXERCISE #7-1

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice or search and record method.

1. List three requirements for a fire department connection for an automatic sprinkler system?

Answer: ______________________________

____

____

OBC Reference ______________________________

2. Portions of a *building* are completely cut off from the remainder (no access to the remainder of the *building)*, which one of the following arrangements will satisfy OBC requirements?
   a) the unobstructed path of travel from the vehicle to any entrance of the *building* is not more than 45 m;
   b) the unobstructed path of travel from the vehicle to one entrance of each portion is not more than 45 m;
   c) hydrants are to be located within 90 m horizontally of any portion of the *building;*
   d) the unobstructed path of travel from the vehicle to one entrance of each portion is not more than 90 m.

OBC Reference ______________________________

3. Describe the steps taken in navigation of the OBC to determine the applicable edition of the standard covering a fire pump having a rated net head pressure greater than 280 kPa?

Answer:

OBC Reference

4. An access route required for fire department use is located so that the principal entrance and every access opening required is an unobstructed distance from the route. Which one of the following distances measured from the face of the *building* meets the requirements of the OBC?
   - a) 15.5 m horizontally
   - b) 2.5 m horizontally
   - c) 3.0 m horizontally
   - d) 3.5 m vertically

OBC Reference

STOP

AUTOMATIC SPRINKLER SYSTEM

As required by Article 3.2.5.13., an automatic sprinkler system is to be designed, constructed, installed and tested in conformance with NFPA 13, "Standard for the Installation of Sprinkler Systems".

Exceptions

Instead of the requirements above,

- NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height", is permitted for the design, construction, installation and testing of an automatic sprinkler system installed in a *building*
    - of *residential occupancy* that is not more than 4 *storeys* in *building height, or*
    - of Group B, Division 3 occupancy that contains sleeping accommodation for not more than 10 persons and not more than 6 occupants require assistance in evacuation in case of an emergency.

- NFPA 13D, "Sprinkler Systems in One- and Two-Family Dwellings and Mobile Homes", is permitted to be used for
    - the design, construction, installation and testing of an automatic sprinkler system installed in a *building* of *residential occupancy* that contains not more than 2 *dwelling units*.

If a *building* contains fewer than 9 sprinklers, the water supply for these sprinklers is permitted to be supplied from the domestic water system for the *building* provided the required flow for the sprinklers can be met by the domestic system.

Other Sprinkler System Requirements

If a water supply serves both an automatic sprinkler system and a system serving other equipment, control valves are required by Article 3.2.5.13. to be provided so that either system can be shut off independently.

Notwithstanding the requirements of the standards referenced above for the installation of automatic sprinkler systems, sprinklers must not be omitted in any room or closet in the storey immediately below a roof assembly if the *fire-resistance rating* of the roof assembly is waived as permitted by Article 3.2.2.17.

Fast response sprinklers are to be installed in *care or detention occupancies* and in *sprinklered residential occupancies*.

Sprinklers in elevator machine rooms are to have a temperature rating not less than that required for an intermediate temperature classification and are to be protected against physical damage.

COMBUSTIBLE SPRINKLER PIPING

Combustible sprinkler piping is to be used only for wet systems in *residential occupancies* and other light hazard *occupancies* as per Article 3.2.5.14.

Combustible sprinkler piping is to meet the requirements of ULC/ORD-199P-M, "Combustible Piping for Sprinkler Systems".

Combustible sprinkler piping is to be separated from the area served by the sprinkler system and from any other *fire compartment* by ceilings, walls, or soffits consisting of, as a minimum

- lath and plaster,
- gypsum board not less than 9.5 mm thick,
- plywood not less than 13 mm thick, or
- a suspended membrane ceiling with
    - steel suspension grids, and
    - lay-in panels or tiles having a mass not less than 1.7 kg/m^2.

If *combustible* sprinkler piping is located above a ceiling, an opening through the ceiling that is not protected in conformance with above is to be located so that the distance between the edge of the opening and the nearest sprinkler is not more than 300 mm.

SPRINKLERED SERVICE SPACE

An automatic sprinkler system is to be installed in a *service space* referred to in Sentence 3.2.1.1.(9) if flooring for access within the *service space* is other than catwalks as required by Article 3.2.5.15.

The sprinkler system required above is to be equipped with waterflow detecting devices, with each device serving not more than one *storey*.

The waterflow detecting devices required is to be connected to the fire alarm system, to

- initiate an *alert signal* in a 2 stage system or an *alarm signal* in a single stage system, and
- indicate separately on the fire alarm system annunciator the actuation of each device.

If a *building* is *sprinklered*, sprinkler protection need not be provided in the space below a raised floor in a *computer room*

- if the optical fibre cables and electrical wires and cables in this space conform to the test requirements in Article 3.1.5.21.,
- if the *building* is of *noncombustible construction* and other *combustible* components are limited to those permitted in Subsection 3.1.5.,
- if this space is used to circulate conditioned air and the air handling system is designed to prevent the circulation of smoke upon a signal from a *smoke detector*,
- if all of this space is easily accessible by providing access sections or panels in the raised floor, and
- if the *computer room* is more than 2 000 m^2 and the annunciator has separate zone indicators of the actuation of *smoke detectors* located in this space so that the coverage for each zone is not more than 2 000 m^2.

Where a room, chute or bin is required to be *sprinklered* as indicated in Sentence 3.3.4.3.(1), Article 3.6.2.5. and Sentence 3.6.3.3.(6), the sprinklers may be supplied with water from the fire standpipe system provided that

- except for a chute, not more than 8 sprinkler heads are required to protect any room or bin based on a maximum coverage of 12 m^2 per sprinkler head,
- the standpipe riser is
  - not less than 6 in. in diameter, or
  - hydraulically designed to meet combined water supply as specified as follows,
- the water supply for a standpipe system, pumping capability and water storage facility, if required, is increased to supply 95 L/min for each sprinkler head over and above the requirements for the standpipe system up to maximum 760 L/min for sprinklers,
- a waterflow detecting device is to be installed in the sprinkler main adjacent to the point of connection to the standpipe riser, and
- the activation of each waterflow detecting device above is to be indicated separately on the fire alarm system annunciator.

STOP

EXAMPLE QUESTION

- Summarize the three specific exceptions to the OBC requirements for conformance to NFPA 13?

Answer: ______________________________

____

____

OBC Reference ______________________________

EXERCISE #7-2

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice or search and record method.

1. A *building* is not *sprinklered* and contains a room used for *combustible* refuse storage and required to be *sprinklered*. It is determined that 6 sprinklers are required and they will be supplied with water from the fire standpipe system. What requirements are to be met to conform with the OBC?

Answer: ______________________________

____

____

OBC Reference ______________________________

2. *Combustible* sprinkler piping is to be separated from the area served by the sprinkler system and from any other *fire compartment* by ceilings, walls, or soffits. Which one of the following does NOT conform to the requirements of the OBC?
    a) 9.5 mm plywood;
    b) 13 mm gypsum board;
    c) lath and plaster;
    d) suspended membrane ceiling with 2.0 kg/m^2 mass tiles.

OBC Reference ______________________________

3. Sprinkler protection is not provided in the space below a raised floor in a *computer room* in a *building* that is *sprinklered*. Summarize the requirements needed to meet the OBC in this case?

Answer: ______________________________

____

____

OBC Reference ______________________________

4. A water supply serves both an automatic sprinkler system and a system serving other equipment, which one of the following is a requirement of the OBC?
    a) A waterflow detecting device is to be installed on the supply pipes to both systems
    b) System pipes not less than 4 in. in diameter.
    c) system pipes not less than 6 in. in diameter
    d) control valves are to be provided so that either system can be shut off independently

OBC Reference ______________________________

STOP

Ontario **Ministry of Municipal Affairs and Housing**

BUILDING SERVICES

PARTICIPANT'S MODULE #8

Additional (Fire Fighting) Requirements for High Buildings

JAN06

INTRODUCTION

In this module the additional requirements for fire fighting in high buildings are reviewed along with the requirements of Supplementary Standard SB-4.

Objectives

Upon completion of this module participants will be able to:
- Identify buildings that are classified as high buildings.
- Identify factors that necessitate additional requirements for high buildings.
- Identify means for smoke control.
- Identify approaches for smoke venting to aid firefighters.
- Identify additional requirements for fire alarm systems and emergency power.

STOP

ADDITIONAL REQUIREMENTS FOR HIGH BUILDINGS

This module will concentrate on understanding the additional requirements for high buildings. Building Code requirements applicable to high buildings are provided in Subsection 3.2.6.

High buildings may be typified by the general characteristics of requiring more time to evacuate in an emergency and increased difficulties in firefighting. This characteristic results principally from the height and occupant load of the building, but may also include major occupancy factors. This includes Group B detention, care and treatment major occupancies in buildings of moderate height, where evacuation of occupants may be difficult due to security or health concerns. In some circumstances, complete evacuation may be impractical and occupants will be relocated to safe portions of a building. Some high building requirements are therefore related to enhanced fire protection within buildings to facilitate a protect-in-place approach.

The height of high buildings may also delay firefighters' response to a fire. Some requirements are therefore related to enhanced fire suppression, firefighters' access and safety.

Tall buildings are also more susceptible to stack effects, than are lower buildings. Stack effects are caused by differences in interior and exterior air temperature and pressures. The effect is most pronounced in winter, when the temperature differential is greatest. During this season, the stack effect causes air to rise from lower to upper storeys in high buildings. In the event of fire, the stack effect can assist to spread the effects of fire vertically throughout the building.

APPLICATION

Article 3.2.6.1. identifies building attributes that result in high building classification and the application of requirements in Subsection 3.2.6. A building is considered a high building if it meets any one of the criteria described in the following table.

TABLE 8-1

Major Occupancy	Characteristic		Code Reference
	Height(1)	Other	
A, D, E, F	> 36 m		3.2.6.1.(1)(a)(i)
	> 18 m	total occupant load above first storey divided by (1.8 x total exit width (m)) >300	3.2.6.1.(1)(a)(ii)
B	> 18 m		3.2.6.1.(1)(b)
	no minimum	B-2 or B-3 occupancy located above 3rd storey	3.2.6.1.(1)(c)
C	> 18 m		3.2.6.1.(1)(d)

(1) Height is measured from "grade" to the floor level of the top storey.

STOP

EXAMPLE QUESTION

- Determine whether the following building is classified a high building:

A 7 *storey* building is constructed with storeys having 4 m floor-to-floor heights. The first 3 storeys contain retail major occupancies and the top 4 floors contain offices. The *first storey* has an occupant load of 675 persons. Each other retail floor has a 450 person occupant load. Each office floor has a 200 person occupant load. The building is served by three 1,400 mm wide exit stairs.

Solution:

Major occupancy: D and E, therefore OBC Clause 3.2.6.1.(1)(a) applies.

Building height: 6 storeys x 4 m/storey = **24 m** to the floor level of the top storey, therefore OBC Subclause 3.2.6.1.(1)(a)(ii) applies.

Cumulative occupant load: (2 x 450) + (4 x 200) = **1 700** persons above the first storey.

Total exit width: 3 exits x 1.4 m = **4.2 m**

Occupant load/exit width factor: 1 700/(1.8 x 4.2) = **225**

The occupant load/exit width factor is less than **300** therefore the building is NOT a high building.

STOP

LIMITS TO SMOKE MOVEMENT

Smoke movement is required to be limited in high buildings to reduce the danger to occupants and firefighters from exposure to smoke from a building fire [3.2.6.2.(1)].

The intent of the Code is to limit the quantity of contaminated air in storeys, other than the storey of fire origin, to not more than 1% by volume for a period of 2 hours, assuming an outdoor temperature equal to the January design temperature on a 2.5% basis [3.2.6.2.(2)].

This represents a performance objective. Prescriptive requirements for achieving this level of performance are not detailed in the Code. Supplementary Standard SB-4 describes a series of measures that are deemed to achieve the required performance. These measures do not prohibit the use of other designs that can be demonstrated to achieve the required performance.

These smoke contamination limits are also applicable to exit stair shafts both above and below exit levels, and to firefighters' elevator shafts, in consideration that these are means of occupant evacuation and emergency response during a fire [3.2.6.2.(3) and (4)].

There are some exemptions from these requirements.

EXERCISE #8-1

For each of the following questions review the presented text and use the applicable OBC references to formulate and record the correct answer.

1. Read Sentences [3.2.6.2.(1) to (6)] and insert appropriate Code references in following table, identifying criteria for exemption from requirements to limit smoke movement.?

TABLE 8-2

OBC Reference	Smoke Control Required.	Exception
3.2.6.2.(2)	Limit smoke movement into non-fire floors	not applicable to sprinklered buildings complying with OBC Reference: Example: 3.2.6.4.(1)(a) through (d); not applicable to Group C buildings with areas of refuge for above grade storeys OBC Reference: ________________ not applicable to Group C buildings not more than 75 m high and satisfying the following formula: O.L. above grade $\leq$ exit area (m^2) x 3.6 OBC Reference: ________________ not applicable to Group C buildings complying with OBC Reference: ________________ not applicable to Group C apartment buildings OBC Reference: ________________

3.2.6.2.(3)(a)	Limit smoke movement into exit stairs above the lowest exit storey	not applicable to sprinklered buildings complying with OBC Reference: ______________________ not applicable to Group C buildings complying with OBC Reference: ______________________ not applicable to Group C apartment buildings OBC Reference: ______________________
3.2.6.2.(3)(b)	limit smoke movement into exit stairs below the lowest exit storey	not applicable to Group C apartment buildings OBC Reference: ______________________
3.2.6.2.(4)	limit smoke movement into fire fighter's elevator shafts	not applicable to sprinklered buildings complying with OBC Reference: ______________________ not applicable to Group C buildings complying with OBC Reference: ______________________

2. Identify which of the following buildings are regulated by Subsection 3.2.6. (Assume first storey is at grade).

a) 15 storey office building having 3.5 m high storeys

OBC Reference:

b) 4 storey hospital with patient care on all storeys. Storey heights are 4 m.

OBC Reference:

c) 6 storey residential building having 3.4 m storey height.

OBC Reference:

3. Why is January selected as the month on which to base designs to limit smoke movement?

OBC Reference:

4. A 15 storey apartment building is constructed with 3.5 m high storeys. Each storey has 20 dwelling units with a combined occupant load of 62 persons. Two 1100 mm wide exits provide a combined tread and landing area of 18.5 m^2. Is this high building exempt from compliance with [3.2.6.2.(2)] to limit smoke movement into non-fire floors?

OBC Reference:

STOP

SPRINKLERED BUILDINGS

Article 3.2.6.4 describes requirements for sprinklered buildings that may be used as an alternative to limiting smoke movement to non-fire floors, exit stairs above lowest exit level and firefighters' elevators in buildings in accordance with Article 3.2.6.2. It is not a requirement applicable to all high buildings, however, it is noted that many high buildings will nonetheless be sprinklered for compliance with construction requirements in Subsection 3.2.2.

Application of this exemption requires that:

- the sprinkler system be electrically supervised to transmit water flow and supervisory signal operation to the building central alarm and control facility, and to one of the following:
    - fire department
    - independent central station
    - proprietary control centre
- stairways serving storeys above the lowest exit level are vented to the exterior near grade (recommended venting is described in Supplementary Standard SB-4.
- smoke movement is limited from storeys below the lowest exit level to storeys above the lowest exit level.
- air moving fans serving more than 2 storeys, other than kitchen/washroom/dwelling unit bathroom exhaust fans and fans intended for smoke venting, are installed with a manually operated switch to enable shut down at the building central alarm and control facility.

RESIDENTIAL BUILDING EXEMPTIONS

Certain residential (Group C) buildings are exempt from complying with some of the smoke control limits of Article 3.2.6.2. as summarized in previous Table 6-2. These consist of the following:

[3.2.6.3]	buildings with areas of refuge
[3.2.6.5]	buildings of limited height
3.2.6.6.(1)	buildings with exterior balconies
3.2.6.6.(2)	apartment buildings

AREAS OF REFUGE

Article 3.2.6.3 describes requirements for areas of refuge that may be used as an alternative to limiting smoke movement to non-fire floors in residential buildings in accordance with Sentence 3.2.6.2.(2). It is not a requirement applicable to all high buildings.

The areas of refuge are permitted to be located at 5 storey intervals, except that they must be located on every storey in buildings more than 75 m high measured between grade and floor level of the top storey.

Areas of refuge are required to be sized to accommodate the occupant load of the floor areas served on the basis of:

- 0.5 m^2/ambulatory occupant
- 1.5 m^2/non-ambulatory occupant.

The width of doors, corridors and stairs providing access to an area of refuge is based on the following factors:

- doorways and corridors on same storey : 3.67 mm/person
- stairs from other storeys : 5.5 mm/person.

An area of refuge is required to control the accumulation of contaminated air to the limits otherwise established in Sentence 3.2.6.2.(2) for non-fire floor areas.

LIMITED BUILDING HEIGHT

Article 3.2.6.5 describes residential buildings that are exempt from limiting smoke movement to non-fire floors in residential buildings required by Sentence 3.2.6.2.(2). It is not an allowance applicable to all high buildings.

The exemption is applied where the residential building:

- Does not exceed 75 m in height between grade and the floor level of the top storey,
- The occupant load above grade does not exceed the area of exit treads and landings multiplied by 3.6 (occupant load < exit area (m^2) x 3.6).

EXTERIOR BALCONIES AND APARTMENT BUILDINGS

Article 3.2.6.6. limits the application of Article 3.2.6.2. as described in Table 6-2 in the following circumstances:

- Buildings with each suite above grade provided with direct access to an exterior balcony at least 1.5 m deep and providing at least 0.5 m^2 space for each occupant, and where the building also complies with the following:
  - stairways serving storeys above the lowest exit level are vented to the exterior near grade.
  - smoke movement is limited from storeys below the lowest exit level to storeys above the lowest exit level.
  - air moving fans serving more than 2 storeys, other than kitchen/washroom/dwelling unit bathroom exhaust fans and fans intended for smoke venting, are installed with a manually operated switch to enable shut-down at the building central alarm and control facility.
- The building is an apartment building.

STOP

EXERCISE #8-2

For each of the following questions review the presented text and use the applicable OBC references to formulate and record the correct answer.

1. When used, areas of refuge are provided?

   a) at maximum 5 storey intervals for high buildings

OBC Reference:

   b) at each storey for high buildings

OBC Reference: ______________________________

2. In a *sprinklered* residential building, identify whether the following air moving fans are required to be capable of being stopped from the central alarm and control facility?

   a) Building HVAC system serving 4 basement storeys of a high building.

OBC Reference: ______________________________

b) Laundry room exhaust for a common laundry room on the second storey of a high building.

____

OBC Reference: ______________________________

c) HVAC system serving a fitness centre on the second and third storeys of a high building.

____

OBC Reference: ______________________________

d) Common bathroom exhaust serving dwelling units through 10 storeys of a high building.

____

OBC Reference: ______________________________

CONNECTED BUILDINGS

Article 3.2.6.7 requires interior connections between buildings, such as through a firewall or walkway, to be designed to limit smoke movement between the buildings if one, or both, of the buildings is classified as a high building.

A common means of compliance is described in Supplementary Standard SB-4, Measure N.

ELEVATORS

Emergency operation of elevators in high buildings is regulated by Article 3.2.6.8. Elevators for firefighters' use are addressed in Article 3.2.6.9.

Emergency recall operation is required for all elevators serving storeys above the first storey.

All elevators require manual recall, initiated by key-operated switches located conspicuously in each elevator lobby at the recall level, and in the central alarm and control facility.

Additional automatic recall operation is required for elevators serving storeys above the first storey in unsprinklered buildings.

Automatic recall is initiated by the building fire alarm system or smoke detection in each elevator lobby in each storey.

Each elevator car is required to be equipped with in-car emergency service switches.

In the event of recall operation, elevators are returned to a designated recall level and the doors are held open for further use via the in-car emergency service controls.

At least one elevator is required to provide firefighters' service. A firefighters' elevator is required to:

- be accessible at the storey having the firefighters' principal entrance from the exterior
- provide access to all storeys above grade normally served by the elevator system
- have a useable platform area of 2.2 m^2
- be capable of transporting a 900 kg load to the top floor within 1 minute

High buildings may be built with separate elevators to serve selected lower and upper portions of a building to improve the efficiency of passenger service. In such cases, no single elevator may access all storeys served by the elevator system. It is therefore permitted to transfer once between elevators to provide fire fighters with access to all floors. In this circumstance, both elevators are designed as firefighters' elevators.

Firefighters' elevator doorways must protect firefighters from fire exposure. This is achieved with any one of the following methods:

- dividing floor areas with fire separations into 2 separate smoke control regions and providing separate firefighters elevator shafts for each region (Measure K Supplementary Standard, SB-4),
- doorway closure interlock mechanisms, including interlock circuits and associated wiring, are designed to operate for at least 1 hour under test fire conditions appropriate for doors,
- doors open into unoccupied vestibules separated from the remainder of the floor area with 45 minute rated fire separations,
- doors open into corridors containing no occupancy and separated from the remainder of the floor area with 1 hour rated fire separations.

VENTING TO AID FIREFIGHTING

Smoke venting of floor areas, both above and below grade, is required in accordance with Article 3.2.6.10.

The following smoke venting methods are permitted in high buildings:

- windows
- wall panels
- smoke shafts

In sprinklered buildings, it is also permitted to vent smoke with the building mechanical exhaust system. This method is particularly useful for storeys below grade.

In no circumstances is it permitted to use an elevator shaft for smoke venting.

Detailed design guidelines for smoke venting system are contained in Section 3 of the Supplementary Standard SB-4.

STOP

EXERCISE #8-3

For each of the following questions review the presented text and use the applicable OBC references to formulate and record the correct answer.

1. Describe 2 conditions of use of windows for smoke venting.

a) Fixed panes:

____

OBC Reference: __________________________________

b) Operable panes:

____

OBC Reference: __________________________________

2. Identify 2 locations where manual elevator recall switches are found?

a) ____

OBC Reference: __________________________________

b) ____

OBC Reference: __________________________________

3. Explain whether an elevator serving only the first storey and 3 basement parking levels of a high building requires emergency recall?

____

____

OBC Reference: ________________________________

STOP

CENTRAL ALARM AND CONTROL FACILITY

A central alarm and control facility is the principal incident command location for firefighters in a fire emergency. It is therefore required that the central alarm and control facility be located on the storey containing the principal entrance for firefighters and in a readily accessible location.

A summary of primary functions is provided in Table 8-3

Detailed requirements are described in Article 3.2.6.12.

TABLE 8-3
Functions of Central Alarm and Control Facility

System	Function		
	Operate	Monitor	Communicate
Fire alarm	X	X	X (1)
Voice communication	X		X
Sprinkler water flow		X	
Sprinkler supervision		X	
Elevator recall	X (2)	X	
Elevator car communication			X (3)
Door hold-open hardware	X		
Electromagnetic locks	X (4)		
Auxiliary equipment	X (5)		

Notes:
(1) send signals to Fire Department
(2) 3.2.6.8.(2)(b)
(3) where required by the Elevating Devices Act
(4) release and reset: 3.4.6.15.(4)(d) & (i)
(5) Communication with a continually staffed auxiliary equipment control centre may be provided in lieu of CACF control

VOICE COMMUNICATION

General requirements for voice communication systems are provided in Article 3.2.6.13. Detailed system requirements are described in Article 3.2.4.22.

A voice communication system allows firefighters in the central alarm and control facility to:

- speak to occupants throughout the building, and
- converse with emergency personnel in:
    - each floor area
    - mechanical control centre (if provided).

A voice communication system assists incident commanders to obtain current information on an emergency event, coordinate emergency response activity and provide reassurance and instructions to building occupants.

A voice communication system is required in buildings with:

- the floor level of the top storey more than 36 m above grade, or
- a Group B, Division 2 or 3 occupancy above the third storey.

PROTECTION OF ELECTRICAL CONDUCTORS

To assist with the continued operation of emergency systems during a fire, critical electrical conductors serving emergency systems are required to be protected from exposure to fire in accordance with Article 3.2.7.10.

With respect to integrity of emergency systems under direct fire exposure, high building emergency systems are expected to operate for at least 1 hour after the start of a fire to maintain the function of these building systems to enable safe evacuation or redistribution of building occupants and to conduct firefighting operations. Where protection is required, electrical conductors are required to conform to

ULC-S139 "Fire Test for Evaluation of Integrity of Electrical Cables", including hose stream application, to provide a circuit integrity rating of not less than 1 h. Electrical power conductors require 1 hour fire protection from the building main emergency power supply to the equipment served, or to the power distribution panel serving the equipment when both are located in the same room. [Sentence 3.2. 7.10(3)] Wiring between fire alarm system central processing units and transponders located in separate rooms is required to be protected from fire exposure for a 1 hour period. [Sentence 3.2.7.10(4)]

In unsprinklered buildings, fire alarm control units and transponders are required to be located in service rooms having 1 hour fire separations and containing no other combustible materials. [Sentence 3.6.2.1.(7) and (8).

Supply conductors for emergency lighting are required to be protected against fire exposure for a 1 hour period between the emergency power supply and the system panel boards. [Sentence 3.2.7.10.(5)]

Electrical conductors may be protected by using conductors having an inherent fire-resistance rating, or enclosing the conductors in a service space separated from the remainder of the building with a fire separation providing the required fire-resistance. [Sentence 3.2.7.10.(2,6)]

Protection of electrical conductors for the operation of a firefighters' elevator is regulated by Sentence 3.2.6.9.(6). These conductors must have an inherent 1 hour fire-resistance rating, or be enclosed in a 1 hour service space containing no other combustible material.

STOP

EXERCISE #8-4

For each of the following questions review the presented text and use the applicable references to formulate and record the correct answer.

1. According to Article 3.2.4.22., operation of the voice communication system will temporarily silence 2 stage fire alarm alert signals to permit voice message transmission, but only after the signals have operated for a minimum time period. Identify the minimum time period?

OBC Reference:

2. A voice communication system must be capable of transmitting voice messages selectively to any zone or zones while maintaining alert or alarm signals to other zones in the building. Identify the applicable Code reference.

OBC Reference:

3. Identify the type of monitoring (audible and/or visual) required at the Central Alarm and Control Facility for the following functions.

Function	Monitoring Required		
	Audible	Visual	Code Reference
Fire alarm alert and alarm signals			
Elevator emergency recall			
Sprinkler system water flow			
Sprinkler supervisory signal			
Sprinkler supervisory audible signal silence			

STOP

Ontario **Ministry of Municipal Affairs and Housing**

BUILDING SERVICES

PARTICIPANT'S MODULE #9

Lighting and Emergency Power Systems

JAN06

INTRODUCTION

In this module the requirements for the lighting of rooms and spaces are examined for both typical *building* operation and under emergency situations (loss of normal electrical power). The arrangements for supply of emergency power for hospitals, fire alarm systems, and building services are also reviewed.

OBJECTIVES

Upon completion of this module participants will be able to:

- Understand minimum lighting requirements;
- Understand the requirements for emergency lighting and power for emergency lighting;
- Understand when emergency power system installation is required;
- Understand the requirements for emergency power system fuel piping and exhaust piping;
- Understand the requirements for emergency power for fire alarm and building services.

STOP

MINIMUM LIGHTING REQUIREMENTS

As described in Article 3.2.7.1., there are specific areas be equipped to provide illumination to an average level not less than 50 lx at floor or tread level and at angles and intersections at changes of level where there are stairs or ramps, including

- an *exit*,
- a *public corridor*,
- a corridor providing *access to exit* for the public,
- a corridor serving patients or residents in a Group B, Division 2 or Division 3 *occupancy*,
- a corridor serving classrooms,
- an electrical equipment room,

- a transformer vault and
- a hoistway pit.

Rooms and spaces used by the public are to be illuminated as described in Article 9.34.2.7. (as follows):

- every public or service area in *buildings*, including a *recreational camp* and a *camp for housing of workers*, is to have lighting outlets with fixtures controlled by a wall switch or panel.
- when provided by incandescent lighting, illumination required above is to conform to Table 9.34.2.7.
- when other types of lighting are used, illumination equivalent to that shown in Table 9.34.2.7. is to be provided.

Table 9.34.2.7.
Lighting for Public Areas
Forming Part of Sentences 9.34.2.7.(2) and (3)

TABLE 9-1

Room or Space	Minimum Illumination, lx	Minimum Lighting Power Density, W/M^2 of *floor area* (incandescent lighting)
Storage rooms	50	5
Service rooms and laundry areas	200	20
Garages	50	5
Public water-closet rooms	100	10
Service hallways and stairways	50	5
Recreation rooms	100	10
Recreational camps and *camps for housing of workers* hallways, corridors, stairways and sleeping areas	100	10
Kitchen	500	50
All other rooms	250	25
Column 1	2	3

As per Article 3.2.7.1., lighting outlets in a *building* of *residential occupancy* are to be provided in conformance with Subsection 9.34.2.

Elevator machine rooms are to be equipped to provide illumination to an average level of not less than 100 lx at floor level.

Every place of assembly intended for the viewing of motion pictures or the performing arts, is to be equipped to provide an average level of illumination at floor level in the aisles of not less than 2 lx during the viewing.

Every area where food is intended to be processed, prepared or manufactured and where equipment or utensils are intended to be cleaned is to be equipped to provide illumination to a level of not less than 500 lx measured at the floor level. Every storage room, dressing room, sanitary facility, service area and corridor serving these areas is to be equipped to provide illumination to a level of not less than 300 lx measured at the floor level.

RECESSED LIGHTING FIXTURES

Article 3.2.7.2. requires that a recessed lighting fixture not be located in an insulated ceiling unless the fixture is designed for this type of installation.

EMERGENCY LIGHTING

Emergency lighting is required by Article 3.2.7.3. to be provided to an average level of illumination not less than 10 lx at floor or tread level in

- *exits*,
- principal routes providing *access to exit* in an open *floor area*
- in *service rooms*,
- corridors used by the public,
- corridors serving patients' or residents' sleeping rooms in a Group B, Division 2 or Division 3 *occupancy*,
- corridors serving classrooms,

- underground *walkways*,
- *public corridors*,
- *floor areas* or parts thereof where the public may congregate in
    - Group A, Division 1 *occupancies*, or
    - Group A, Division 2 and 3 *occupancies* having an *occupant load* of 60 or more,
- *floor areas* or parts of them in day care centres where persons are cared for,
- food preparation areas in commercial kitchens,
- principal routes providing *access to exit* in a *floor area* that is not subdivided into rooms or *suites* of rooms served by corridors in a *business and personal services occupancy*, a *mercantile occupancy* or an *industrial occupancy*, and
- internal corridors or aisles serving as principal routes to *exits* in a *business and personal services occupancy*, a *mercantile occupancy* or an *industrial occupancy* that is subdivided into rooms or *suites* of rooms, and is not served by a *public corridor*.

As stated in Article 3.2.7.3., emergency lighting to provide an average level of illumination of not less than 10 lx at floor or catwalk level is to be included in a *service space* referred to in Sentence 3.2.1.1.(9).

The minimum value of the illumination above must be not less than 1 lx (the 10 lx required above is an average level – no part of the space is to be illuminated at less than 1 lx).

EMERGENCY POWER FOR LIGHTING

As described in Article 3.2.7.4., an emergency power supply is to be

- provided to maintain the required emergency lighting from a power source such as batteries or generators that will continue to supply power in the event that the regular power supply to the *building* is interrupted, and

- so designed and installed that upon failure of the regular power it will assume the electrical load automatically for a period of
  - 2 h for a *building* within the scope of Subsection 3.2.6.,
  - 1 h for a *building* of Group B *major occupancy* classification that is not within the scope of Subsection 3.2.6., and
  - 30 min for a *building* of any other *occupancy*.

If self-contained emergency lighting units are used, they are to conform to CSA C22.2 No. 141, "Unit Equipment for Emergency Lighting".

STOP

EXAMPLE QUESTION

- Regarding the areas where food is processed, and the areas supporting and serving those processing areas, what are the associated required illumination levels?

Answer: ____

____

____

OBC Reference ____

EXERCISE #9-1

For each of the following questions review the presented text and use the applicable OBC references to identify the correct answer.

1. Summarize the three levels (according to *occupancy* or *building* type) of minimum duration time of power source availability for required emergency lighting?

Answer: ____

____

OBC Reference ______________________________________

2. Which one of the following is the minimum value of illumination (in lx), allowed for emergency lighting in *exits* and corridors used by the public?
    - a) 1
    - b) 10
    - c) 100
    - d) 0.9

OBC Reference ______________________________________

3. Describe the required action of emergency power for lighting upon failure of regular power?

Answer: ____

____

____

OBC Reference ______________________________________

4. A public garage has an area of 200 m^2. Based on Article 3.2.7.1, what is the minimum watts of incandescent lighting required for the area?
   - a) 50
   - b) 1000
   - c) 10000
   - d) 200

OBC Reference ______________________________

STOP

EMERGENCY POWER SUPPLY INSTALLATION

In accordance with Article 3.2.7.5., an emergency electrical power system is to be installed in conformance with CSA-C282, "Emergency Electrical Power Supply for Buildings", except as required by the following,

EMERGENCY POWER FOR HOSPITALS

An emergency electrical power system for emergency equipment required by Article 3.2.7.6. for hospitals is to be installed in conformance with CSA-Z32, "Electrical Safety and Essential Electrical Systems for Health Care Facilities", except as required by the following,

FUEL SUPPLY SHUT-OFF VALVES AND EXHAUST PIPES

As per Article 3.2.7.7., if a liquid or gas fuel-fired engine or turbine for an emergency electric power supply is dependent on a fuel supply from outside the *building*, the fuel supply is to be provided with a suitably-identified separate shut-off valve outside the *building*.

Where pipes for exhaust gases from emergency power systems penetrate required *fire separations*, they are to be enclosed in a separate *service space* having a *fire-resistance rating* equal to that of the penetrated floor assembly, but not less than 45 min.

EMERGENCY POWER FOR FIRE ALARM and Voice Communication SYSTEMS

The requirements for emergency power for fire alarm and voice communication systems are described in Article 3.2.7.8.

An emergency power supply is to be provided for fire alarm and voice communication systems.

The required emergency power supply is to be supplied from

a generator, batteries, or a combination thereof.

The required emergency power supply is to be capable of providing

- supervisory power for not less than 24 h, and
- immediately following, emergency power under full load for not less than
  - 2 h for a *building* within the scope of Subsection 3.2.6.,
  - 1 h for a *building* classified as Group B *major occupancy* that is not within the scope of Subsection 3.2.6.,
  - 5 min for a *building* not required to be equipped with an annunciator, and
  - 30 min for any other *building*.

The required emergency power is to be designed so that there will be automatic transfer to emergency power with no loss of information in the event of a failure of the normal power source.

EMERGENCY POWER FOR BUILDING SERVICES

An emergency power supply capable of operating under a full load for not less than 2 h is required by Article 3.2.7.9. to be provided by an emergency generator for

- every elevator serving *storeys* above the *first storey* in a *building* that is more than 36 m high measured between *grade* and the floor level of the top *storey* and every elevator for firefighters,
- water supply for fire-fighting in conformance with Article 3.2.5.7., if the supply is dependent on electrical power supplied to the *building*, and the *building* is within the scope of Subsection 3.2.6.,
- fans and other electrical equipment that are installed to maintain the air quality specified in Article 3.2.6.2., and
- fans required for venting by Article 3.2.6.10.

The emergency power supply for elevators required above is to be capable of operating all elevators for firefighters plus one additional elevator simultaneously.

This requirement does not apply if the time to recall all elevators under emergency power supply is not more than 5 min, each from its most remote *storey* to

- the *storey* containing the entrance for firefighter access referred to in Articles 3.2.5.4 and 3.2.5.5., or
- to a transfer lobby.

WATER SUPPLY

An emergency power supply capable of operating under a full load for not less than 30 min is to be provided by emergency generator for water supply for fire-fighting in conformance with Article 3.2.5.7., if the supply is dependent on electrical power supplied to the *building*, and the *building* is not within the scope of Subsection 3.2.6.

The above does not apply to the water supply for a standpipe system.

STOP

EXAMPLE QUESTION

- What is the full name and applicable edition year of the standard for the installation of emergency power systems in hospitals?

Answer: ______________________________

____

____

OBC Reference ______________________________

EXERCISE #9-2

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer.

1. For compliance with the OBC, what arrangements are required for an emergency diesel exhaust stack penetrating a floor assembly with a *fire-resistance rating* of 30 min?

Answer: ______________________________

____

____

OBC Reference ______________________________

2. A *building* requires the installation of a fire alarm system with only a main control panel. Which one of the following is the minimum time required for the emergency power for the fire alarm system to provide supervisory power?
   a) 5 min
   b) 24 h
   c) 2 h
   d) 30 min

OBC Reference ______________________________

3. Describe the exception to the requirement to provide full load emergency power to every elevator (and every elevator for firefighters) serving *storeys* above the *first storey* in a *building* that is more than 36 m high measured between *grade* and the floor level of the top *storey*?

Answer: __________________________________

____

OBC Reference ______________________________

4. A battery type emergency power supply is provided for a voice communication system required by Article 3.2.6.13. What is the required minimum battery capacity for electrical supervision, trouble signal and to operate voice communication?
   a) 30 min
   b) 24 h
   c) 24 h, 1 h
   d) 5 min

OBC Reference ______________________________

STOP

Ontario Ministry of Municipal Affairs and Housing

BUILDING SERVICES

PARTICIPANT'S MODULE #10

Mezzanines and Opening through Floor Assemblies

JAN06

INTRODUCTION

The particular requirements for building services in *buildings* containing an *interconnected floor space* are examined. Many building services have an active role in assisting in conformance with the OBC, for *buildings* containing an *interconnected floor space*.

OBJECTIVES

Upon completion of this module participants will be able to:

- Understand the concept of *interconnected floor space;*
- Understand the concept and requirements of air supply to *exits* in *buildings* containing an *interconnected floor space;*
- Understand the requirements for elevators in *buildings* containing an *interconnected floor space;*
- Understand the requirements for sprinklers in *buildings* containing an *interconnected floor space;*
- Understand the requirements for fire alarm and detection systems in *buildings* containing an *interconnected floor space;*
- Understand the requirements for smoke control and the provision of a mechanical air supply in *buildings* containing an *interconnected floor space;*
- Understand the requirements for emergency power supply in *buildings* containing an *interconnected floor space;*
- Understand the requirements for testing of smoke control and venting in *buildings* containing an *interconnected floor space.*

STOP

MEZZANINES AND OPENINGS THROUGH FLOOR ASSEMBLIES

Exits (Article 3.2.8.4.)

A *building* that is

- more than 18 m in height, measured between *grade* and the floor level of the top *storey*, and that
- contains an *interconnected floor space*, is to be designed to
- limit the passage of smoke from a fire into *exit* stairshafts opening into an *interconnected floor space* so that
- during a 2 h period after the start of fire, such stairshafts will
    - not contain more than 1% by volume of contaminated air from the fire floor,
    - assuming an outdoor temperature equal to the January design temperature on a 2.5% basis.

Where a *building* containing an *interconnected floor space* is more than 75 m in height, the *exit* stairshaft protection is to be accomplished by the provision (between each *floor area* and each *exit* stairshaft) of a vestibule provided with a mechanical air supply or with a vent opening to the outdoors.

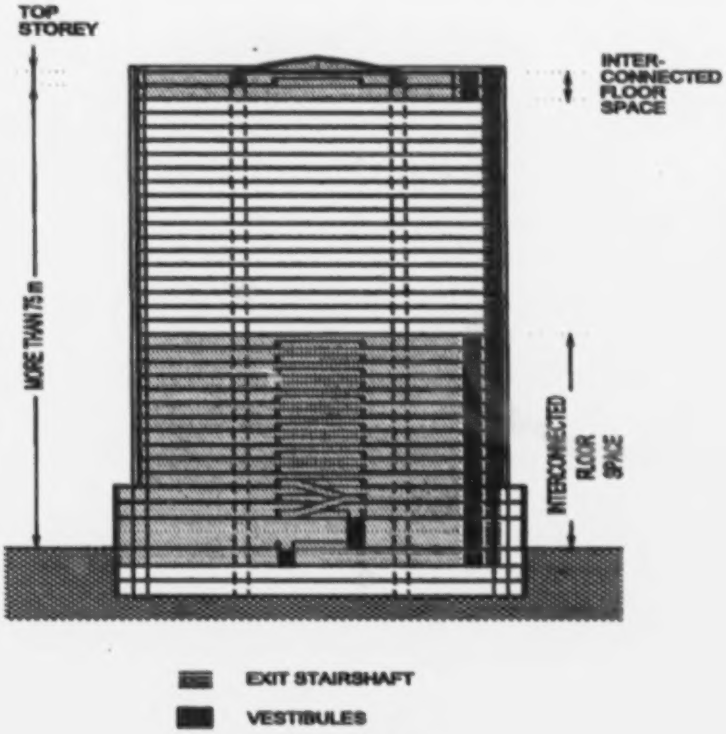

TOP STOREY
INTER-CONNECTED FLOOR SPACE
MORE THAN 75 m
INTERCONNECTED FLOOR SPACE
EXIT STAIRSHAFT
VESTIBULES

FIGURE 10-1

Where a vestibule protecting an *exit* stairshaft is incorporated into the design of the *building* to meet the above requirements, it is to

- be designed so that each doorway for a door opening into the vestibule is located at least 1800 mm from a door or doors opening outward from the vestibule,
- be separated from the remainder of the *floor area* by a *fire separation* having a *fire-resistance rating* at least equal to that required for the *exit* which it serves except that the *fire-resistance rating* of a *fire separation* between the vestibule and a *public corridor* need not exceed 45 min, and
- not have a door or doors opening into more than one *exit* stairshaft.

An illustrative sketch is included below:

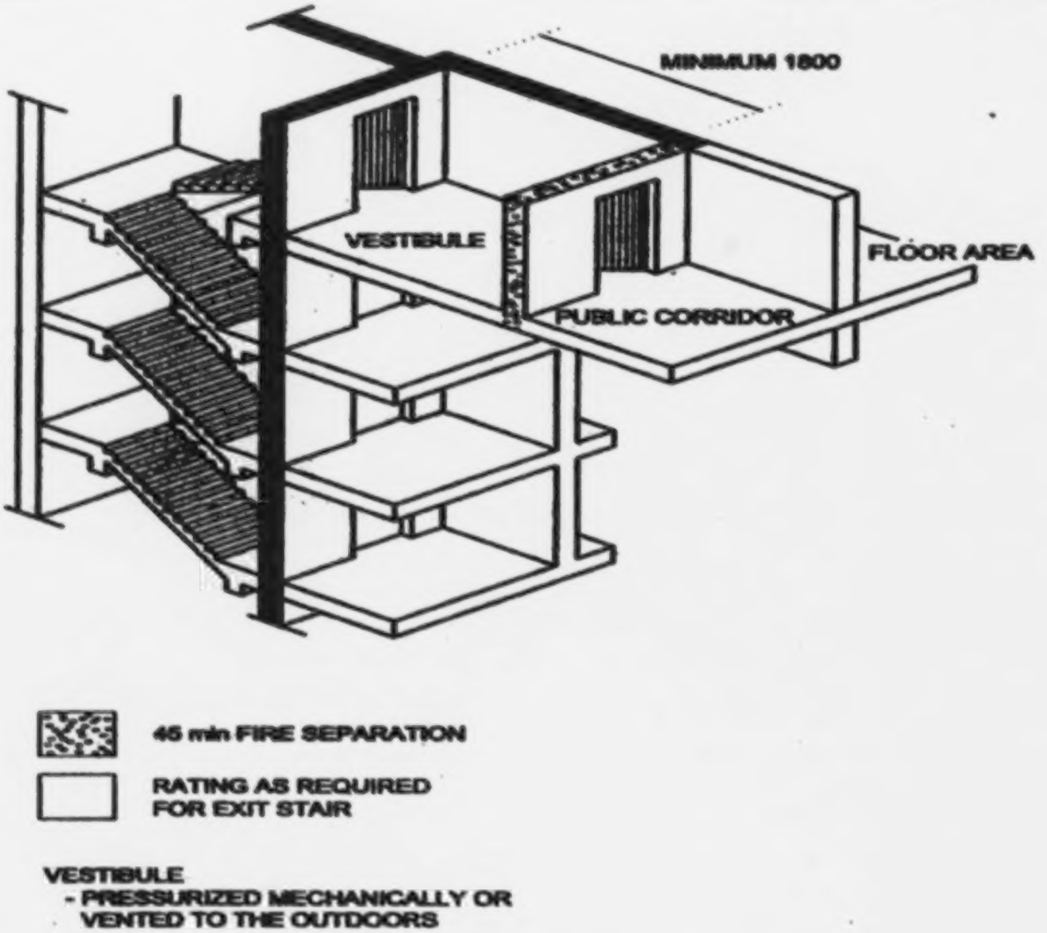

MINIMUM 1800
VESTIBULE
FLOOR AREA
PUBLIC CORRIDOR
▨ 45 min FIRE SEPARATION
☐ RATING AS REQUIRED FOR EXIT STAIR
VESTIBULE
- PRESSURIZED MECHANICALLY OR VENTED TO THE OUTDOORS

FIGURE 10-2

ELEVATORS

As described in Article 3.2.8.5., where an elevator shaft opens into an *interconnected floor space* and into *storeys* that are above such space and that have floor levels more than 18 m above *grade*, either the elevator doors opening into the *interconnected floor space* or the elevator doors opening into the *storeys* above the *interconnected floor space* are to be protected by vestibules that

- are designed to restrict the passage of contaminated air to the limit described in Sentence 3.2.8.4.(1), and
- conform to the requirements of Sentence 3.2.8.4.(3).

Illustrative sketch below:

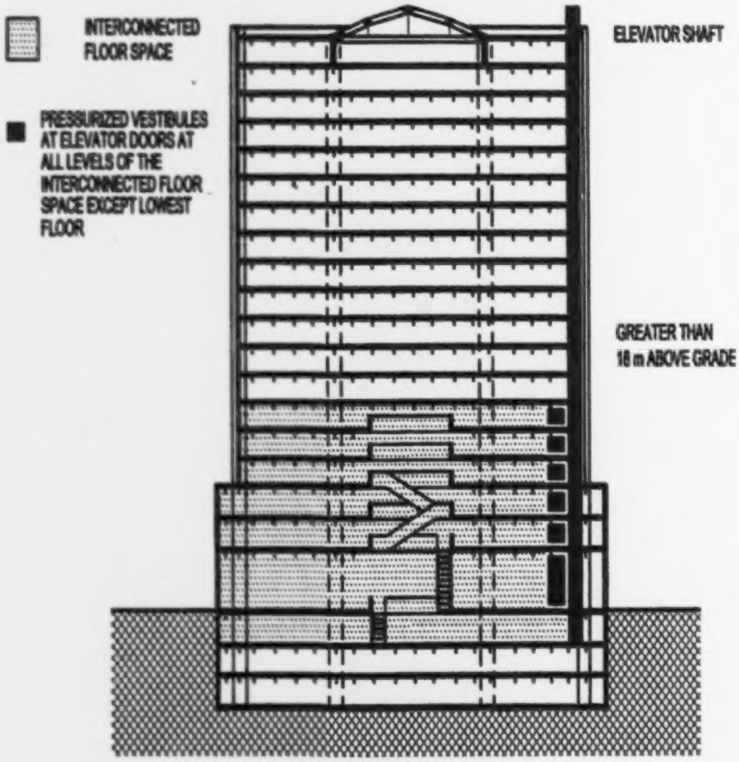

INTERCONNECTED FLOOR SPACE
PRESSURIZED VESTIBULES AT ELEVATOR DOORS AT ALL LEVELS OF THE INTERCONNECTED FLOOR SPACE EXCEPT LOWEST FLOOR
ELEVATOR SHAFT
GREATER THAN 18 m ABOVE GRADE

FIGURE 10-3

Exception: Where elevator doors opening into an *interconnected floor space* are protected by vestibules, the elevator doors opening into the lowest *storey* of the *interconnected floor space* need not be protected by such vestibules as per Article 3.2.8.5.

Illustrative sketch below:

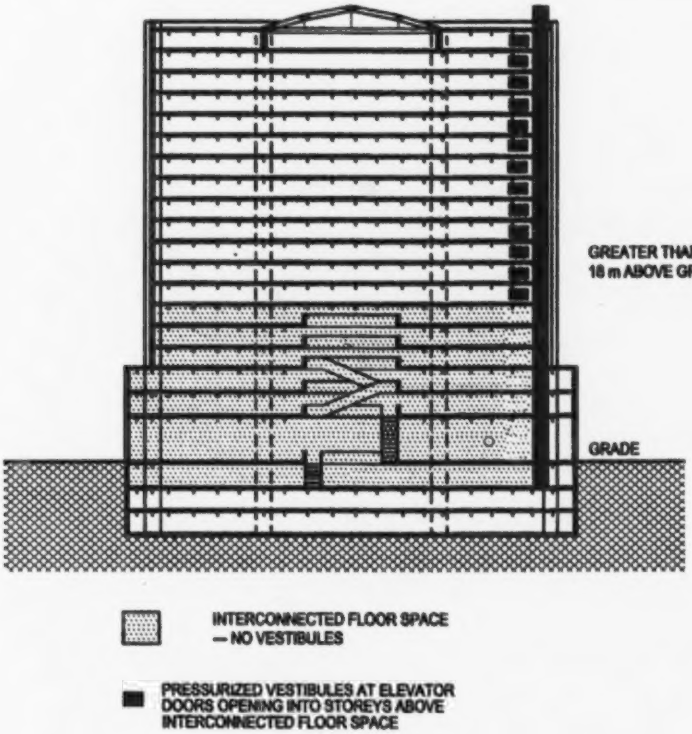

GREATER THAN
18 m ABOVE GRADE
GRADE
▨ INTERCONNECTED FLOOR SPACE
— NO VESTIBULES
■ PRESSURIZED VESTIBULES AT ELEVATOR DOORS OPENING INTO STOREYS ABOVE INTERCONNECTED FLOOR SPACE

FIGURE 10-4

GROUP B SLEEPING ROOMS

As required by Article 3.2.8.6., openings provided for access between an *interconnected floor space* and a *building* or a portion of a *building* containing Group B *major occupancy* sleeping rooms are to be provided with vestibules that are provided with a mechanical air supply and that are designed

- to restrict the passage of smoke from the *interconnected floor space* into the area containing sleeping rooms in accordance with the limits described in Sentence 3.2.8.4.(1), and
- in conformance with Clause 3.2.8.4.(3)(a).

Illustrative sketch below:

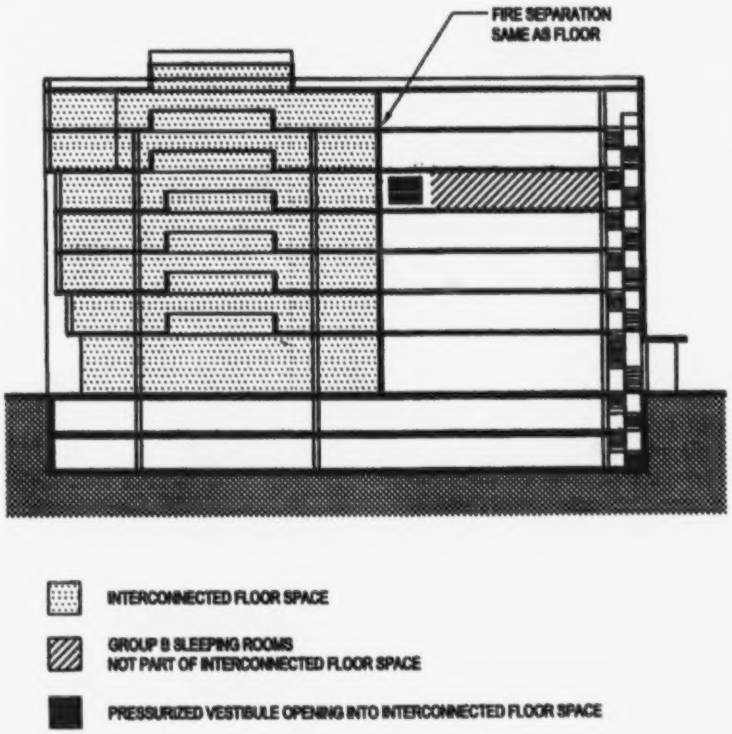

FIRE SEPARATION SAME AS FLOOR
INTERCONNECTED FLOOR SPACE
GROUP B SLEEPING ROOMS NOT PART OF INTERCONNECTED FLOOR SPACE
PRESSURIZED VESTIBULE OPENING INTO INTERCONNECTED FLOOR SPACE

FIGURE 10-5

EXAMPLE QUESTION

- Summarize the duration of protection, limit level of contaminates, and the design temperature basis for the required protection of *exits* in a *building* containing an *interconnected floor space*?

Answer: ____

____

____

OBC Reference ____________________________________

EXERCISE #10-1

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice or search and record method.

1. Describe the intent or purpose for the mechanical air supply required in vestibules that are the access between an *interconnected floor space* and a *building* or a portion of a *building* containing Group B *major occupancy* sleeping rooms?

Answer: ______________________________

____

____

OBC Reference ______________________________

2. Which one of the following combination of conditions requires that *exit* stairshaft protection be accomplished by the provision (between each *floor area* and each *exit* stairshaft) of a vestibule provided with a mechanical air supply or with a vent opening to the outdoors.
    a) *building* containing an *interconnected floor space* is more than 75 m in height
    b) *building* containing an *interconnected floor space* is more than 18 m in height
    c) *building* containing a Group B *occupancy* and is more than 75 m in height
    d) more than 100 m in height, any *occupancy*

OBC Reference ______________________________

STOP

SMOKE CONTROL

A smoke control system is to be designed to control the movement of smoke within a *building* containing an *interconnected floor space* as discussed in Article 3.2.8.9.

The design of the smoke control system is to assume an outdoor temperature equal to the January design temperature on a 2.5% basis.

Upon activation of the sprinkler system or automatic detection of smoke by at least two *smoke detectors* in a single zone within an *interconnected floor space*, the system is to

- stop air moving fans which provide for the normal exhausting or re-circulating of air in an *interconnected floor space*,
- activate *exit* stairshaft protection required in Article 3.2.8.4.,
- activate elevator protection required in Article 3.2.8.5., and
- activate the vestibule air supply required in Sentence 3.2.8.6.(1).

As per Article 3.2.8.9., a *building* containing an *interconnected floor space* may be designed so that, in the event of a fire arising in a *floor area* or part of a *floor area* within the *interconnected floor space*, automatic detection of such fire will activate air handling equipment that

- extracts air directly from such *floor area* or part of a *floor area* at the rate of at least 6 air changes per hour, and
- supplies air in sufficient quantities and at appropriate locations to prevent smoke from passing out of such *floor area* into other portions of the *interconnected floor space*.

Illustrative sketch below:

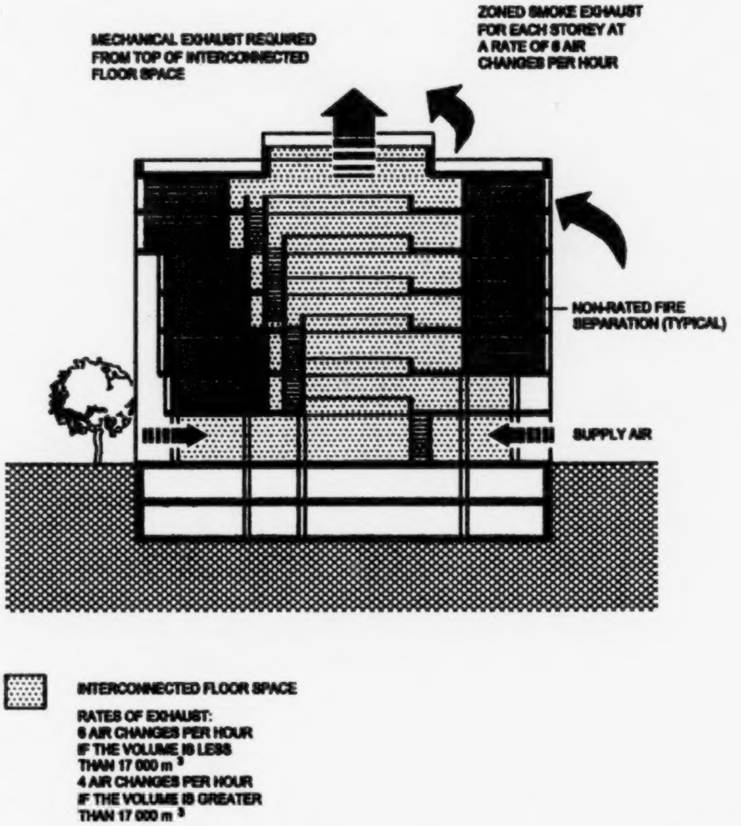

MECHANICAL EXHAUST REQUIRED FROM TOP OF INTERCONNECTED FLOOR SPACE
ZONED SMOKE EXHAUST FOR EACH STOREY AT A RATE OF 6 AIR CHANGES PER HOUR
NON-RATED FIRE SEPARATION (TYPICAL)
SUPPLY AIR
INTERCONNECTED FLOOR SPACE
RATES OF EXHAUST:
6 AIR CHANGES PER HOUR IF THE VOLUME IS LESS THAN 17 000 m 3
4 AIR CHANGES PER HOUR IF THE VOLUME IS GREATER THAN 17 000 m 3

FIGURE 10-6

The volume of an *interconnected floor space* (used below) need not include the aggregate volume of those *floor areas* or portions of *floor areas* designed to have zoned air extraction.

A mechanical exhaust is to be provided to remove air at the top of an *interconnected floor space* at the rate of at least 6 air changes per hour. Where the volume of the *interconnected floor space* exceeds 17,000 m^3, only 4 air changes per hour need be provided.

Illustrative sketch below:

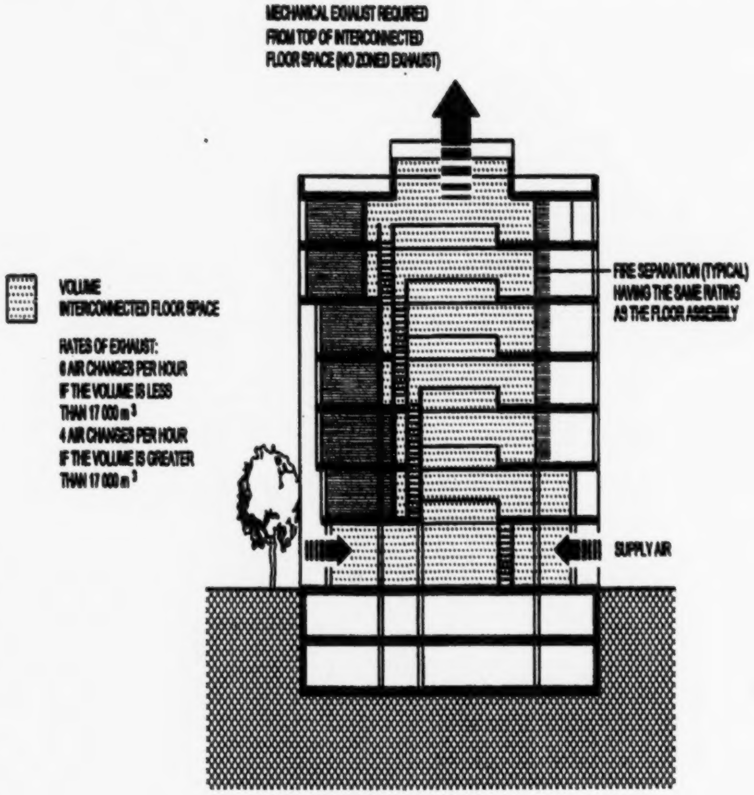

MECHANICAL EXHAUST REQUIRED
FROM TOP OF INTERCONNECTED
FLOOR SPACE (NO ZONED EXHAUST)
VOLUME
INTERCONNECTED FLOOR SPACE
RATES OF EXHAUST:
6 AIR CHANGES PER HOUR
IF THE VOLUME IS LESS
THAN 17 000 m³
4 AIR CHANGES PER HOUR
IF THE VOLUME IS GREATER
THAN 17 000 m³
FIRE SEPARATION (TYPICAL)
HAVING THE SAME RATING
AS THE FLOOR ASSEMBLY
SUPPLY AIR

FIGURE 10-7

Upon automatic detection of smoke within the volume of the *interconnected floor space*, the mechanical exhaust is to be automatically activated and supply air is to be provided in sufficient quantity and at appropriate locations to allow a consistent rate of removal of smoke throughout the volume of the *interconnected floor space*.

Overriding manual controls for the smoke control system is to be provided for fire department use at an acceptable location in the vicinity of the fire alarm annunciator.

STOP

EXAMPLE QUESTION

- How does the volume of the *interconnected floor space* effect the design of a required smoke control systems?

Answer: ______________________________

____

____

OBC Reference ______________________________

EXERCISE #10-2

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice search and record method.

1. A *building* contains an *interconnected floor space* and a smoke control system. Upon automatic detection of smoke by two *smoke detectors* in adjacent zones within an *interconnected floor space*, what HVAC systems response will be seen?

Answer: ______________________________

____

____

OBC Reference ______________________________

2. In what vicinity are the overriding manual controls for the smoke control system provided, for fire department use?
   - a) of the transfer lobby
   - b) of the fire alarm system emergency power control
   - c) of a protected exit
   - d) of the fire alarm annunciator

OBC Reference ______________________________

STOP

SPRINKLERS

Article 3.2.8.7. requires that in a *building* containing an *interconnected floor space*, *storeys* that are wholly or partially within an *interconnected floor space* and all *storeys* below an *interconnected floor space* are to be *sprinklered*.

In a *building* containing an *interconnected floor space*

- waterflow alarm signals from sprinkler systems are to be transmitted to the fire department in conformance with Sentence 3.2.4.7.(4), and

- sprinkler systems are to be electrically supervised as required in Sentence 3.2.4.9.(2).

FIRE ALARM AND DETECTION SYSTEM

As per Article 3.2.8.8., a *building* containing an *interconnected floor space* is to be provided with

- a fire alarm system and electrically supervised annunciator conforming to Subsection 3.2.4.,

- a system of *smoke detectors* located

    - on the ceiling of each *storey* in the vicinity of the openings through floor assemblies described in Article 3.2.8.3., except within dwelling units, *heat* *detectors* may be installed instead of *smoke detectors*, and

  - as required for the activation of the smoke control system described in Article 3.2.8.9 Smoke Control, and

- facilities for transmitting a signal to the fire department in conformance with Article 3.2.4.7.

EMERGENCY POWER SUPPLY

In a *building* that is more than 18 m in height, an emergency power supply capable of operating under a full load for at least 2 h is required by Article 3.2.8.10. to be provided by

- an emergency generator or by
- a separate service not supplied by the same substation as the primary source for fans required for smoke control purposes.

TESTING

Article 3.2.8.11. requires the systems for smoke control and venting described above be tested to ensure satisfactory operation.

STOP

EXAMPLE QUESTION

- What are the requirements and exceptions for an emergency power supply in a *building* with an *interconnected floor space*?

Answer: ______________________________________

____

____

OBC Reference ______________________________________

EXERCISE #10-3

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice search and record method.

1. Summarize how the presence of an *interconnected floor space* in a building effects the application and requirements for sprinklers ?

Answer: ______________________________________

____

____

OBC Reference ______________________________________

2. Which one of the following is an optional requirement regarding the required fire alarm system for a *building* of *business and personal services occupancy* containing an *interconnected floor space*?
    a) facilities for transmitting a signal to the fire department
    b) smoke detectors
    c) automatic activation of the smoke control system
    d) heat detectors

OBC Reference ____________________________________

STOP

Ontario

Ministry of Municipal Affairs and Housing

BUILDING SERVICES

PARTICIPANT'S MODULE #11

Standpipe Systems

JAN06

INTRODUCTION

This module covers standpipe systems requirements for design and installation, water supply, hose stations, hose cabinets, and area coverage of systems.

OBJECTIVES

Upon completion of this module participants will be able to:

- Be able to identify where standpipe systems are required;
- Understand the requirements of standpipe system design;
- Understand the requirements of hose stations and hose connections;
- Understand the requirements for system monitoring by a fire alarm;
- Understand the requirements for water supply for 38 mm and 65 mm hose connections.

STOP

STANDPIPE SYSTEMS

Where Required Above Grade

As per Sentence 3.2.9.1.(1), a standpipe system is to be installed in every *building* that

- is more than 3 *storeys* in *building height*,
- is more than 14 m high measured between *grade* and the ceiling of the top *storey*, or
- has a *building area* exceeding the area shown in Table 3.2.9.1. for the applicable *building height,* if the *building* is not *sprinklered*.

Basements and Below Ground

Sentence 3.2.9.1.(2) requires a standpipe system to be installed in every *basement* of a *building* that requires a standpipe system above *grade*.

A standpipe system is to be installed in every *basement* of a *building* erected partially or entirely below the adjoining finished ground level and extends more than one *storey* below that ground level (Sentence 3.2.9.1.(3)).

Exceptions – Smaller Spaces and Open-Air Garages

A standpipe system is not required in the lowest *storey* in a *building* if this *storey* is a *service room,* which has an area not more than 50 m^2 as per Sentence 3.2.9.1.(4).

As per Sentence 3.2.9.1.(5), a standpipe system is not required in a roof-top enclosure if this enclosure has an area not more than 50 m^2.

Table 3.2.9.1.Building Limits without Standpipe Systems
Forming Part of Sentence 3.2.9.1.(1)

TABLE 11-1

Occupancy Classification	*Building Area*, m^2		
	1 *Storey*	2 *Storeys*	3 *Storeys*
A	2 500	2 000	1 500
C	2 000	1 500	1 000
D	4 000	3 000	2 000
F, Division 2	2 000	1 500	1 000
F, Division 3	3 000	2 000	1 000
Column 1	2	3	4

As per Sentence 3.2.9.1.(6), a standpipe system is not required in an *open-air storage garage* of *noncombustible construction*, not more than 15 m high, not more that 10,000 m^2 in *building area* and conforming to Article 3.2.2.83.

Exception for Dwelling Unit

An exemption found in Sentence 3.2.9.1.(7) states that a standpipe system is not required to be installed in a *dwelling unit* which

- extends not more than 3 *storeys* above adjacent ground level,
- is completely cut off from the remainder of the *building*

so that there is no access to the remainder of the *building*, and

- has direct access to its interior by means of an exterior doorway located not more than 1500 mm above or below adjacent finished ground level.

STOP

EXAMPLE QUESTION

- Which one of the following *building* characteristics results in the requirement for a standpipe system to be installed in a *storage garage* 8000 m^2 in *building area* and otherwise conforming to Article 3.2.2.83.?
    - a) *noncombustible construction*
    - b) *building height* of 16 m
    - c) every portion of each *floor area* is within 60 m of an exterior wall opening
    - d) *open-air arrangement*

OBC Reference ______________________

EXERCISE #11-1

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. A *building* with a *building height* of 14 m (45 ft 11 in) is not *sprinklered*. Which one of the following *building areas*, *occupancy* classification and number of *storeys* will require the installation of a standpipe system?
    - a) *occupancy* classification Group D, 1 storey, 2000 m^2
    - b) *occupancy* classification Group FDivision 3, 2 storey, 1500 m^2
    - c) *occupancy* classification Group A, 3 storey, 2000 m^2
    - d) *occupancy* classification Group C, 2 storey, 1000 m^2

OBC Reference ______________________

2. A *building* includes a roof-top enclosure and requires a standpipe system. Which one of the following enclosure areas requires standpipe coverage?
    - a) 50 m^2
    - b) 55 m^2
    - c) 5 m^2
    - d) none of the above

OBC Reference ______________________________

3. A three *storey sprinklered building* 14 m (45 ft 11 in) high may require a standpipe system depending on *building area* and *occupancy* classifications. Which one of the following conditions is correct?
    - a) occupancy classification Group A, 2000m^2, therefore standpipe required
    - b) occupancy classification Group D, 1500m^2, therefore standpipe required
    - c) occupancy classification Group C, 1000m^2, therefore standpipe required
    - d) none of the above

OBC Reference ______________________________

4. From Table 3.2.9.1., which of the following *occupancy*/building height combination results in the greatest allowable *building area* building limit ?
    - a) Group D, 2 *storeys*
    - b) Group A, 1 *storey*
    - c) Group D, 1 *storey*
    - d) Group F Div 3, 1 *storey*

OBC Reference ______________________________

STOP

STANDPIPE SYSTEM DESIGN

As stated in Sentence 3.2.9.2.(1), the design, construction, installation and testing of a standpipe system are to be in conformance with NFPA 14, "Installation of Standpipe and Hose Systems", except as modified and otherwise provided in Subsection 3.2.9. Standpipe Systems.

Modifications to the Requirements of NFPA 14

A standpipe riser is to be located in an *exit* stair shaft, or a *service space*.

Dry Standpipe Not Connected

A dry standpipe that is not connected to a water supply is not considered as fulfilling the requirements of standpipe system design as per Sentence 3.2.9.2(2).

Dry Standpipe Connected

If freezing of piping may occur, Sentence 3.2.9.2.(8) stipulates that a dry standpipe system may be provided and so arranged through the use of *listed* devices to

- automatically admit water to the system by opening of a hose valve, and
- transmit a signal to an attended location.

Water Supply and Pressure

Sentence 3.2.9.2.(3) requires that if more than one standpipe is provided, the total water supply need not be more than 30 L/s.

As per Sentence 3.2.9.2.(4), the residual water pressure at the design flow rate at the hydraulically most remote hose connection of a standpipe system that is required to be installed in a *building* is permitted to be less than 450 kPa provided that

- the *building* is *sprinklered*,
- the water supply at the base of the sprinkler riser is capable of meeting the design flow rate and pressure

demand of the sprinkler system, including the inside and outside hose allowance, and

- fire protection equipment is available to deliver, by means of the fire department connection, the full demand flow rate at a residual water pressure of 450 kPa at the hydraulically most remote hose connection of the standpipe system.

Fire Department Connections and Fire Pumps

A fire department connection is to be provided for every standpipe system as per Sentence 3.2.9.2.(5)..

Pumps having a rated net head pressure greater than 280 kPa and their controllers are to be *listed* and labeled as required by Sentence 3.2.9.2.(6)..

As stipulated by Sentence 3.2.9.2.(7), couplings for hoses or other fittings used in connection with such couplings are to conform to ULC-S513, "Threaded Couplings for 38 mm and 65 mm Fire Hose" or ULC-S543, "Internal Lug Quick Connect Couplings for Fire Hose".

Supervisory Signal Annunciation for Valves

As covered in Article 3.2.9.5., if a fire alarm system in a *building* has an annunciator, each valve (except for hose valves) controlling water supplies in a standpipe system is to be equipped with an electrically supervised switch for transmitting a signal for individual annunciation in the event of movement of the valve handle.

STOP

EXAMPLE QUESTION

- Which one of the following is NOT a requirement NOR a design condition for a dry standpipe system?
  - a) automatically admit water to the system by opening of a hose valve
  - b) transmit a signal to an attended location
  - c) freezing of piping may occur
  - d) no connection to a water supply

OBC Reference ______________________

EXERCISE #11-2

For each of the following questions, review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1) The OBC permits the residual water pressure in a standpipe system to be less than 450 kPa under a set of conditions. Which one of the following is a specific part of that set of conditions?
   - a) the building is sprinklered
   - b) the system conforms to NFPA 14
   - c) dry standpipes are connected to a water supply
   - d) provision of a fire department connection

OBC Reference ______________________

2) The OBC describes where locations of standpipe risers are permitted. Which one of the following does NOT meet the requirements of the OBC?
   - a) located in an exit stair shaft
   - b) located in electrical riser rooms
   - c) located in a mechanical shaft space
   - d) located adjacent to the garbage chute

OBC Reference ______________________

3) If a fire alarm system in a *building* has an annunciator, it is to be equipped with an electrically supervised switch for transmitting a signal for individual annunciation in the event of what occurrence regarding the standpipe system?
   a) operation of the excess pressure pump
   b) movement of a valve handle (except hose valve)
   c) opening of a hose cabinet door
   d) movement of a hose valve handle

OBC Reference ______________________________

STOP

HOSE CONNECTIONS

As discussed in Article 3.2.9.3.m if a standpipe system is required in a *building*, 38 mm diameter hose connections are to be provided in each *storey* in the *building*.

In addition, if a standpipe system is required, Sentence 3.2.9.3.(2) requires that 65 mm diameter hose connections are to be installed in each *storey* in the *building* if the *building*

- is more than 25 m high, measured between *grade* and the ceiling of the top *storey*, or
- has a *building area* of more than 4000 m^2.

HOSE STATIONS

If a standpipe system is required in a *building*, hose stations are to be provided in each *storey* in the *building* in accordance with Article 3.2.9.4..

Each hose station is to be equipped with a hose rack filled with not more than 30 m of 38 mm diameter fire hose. The hose rack and fire hose is to be *listed* or approved by the Factory Mutual Research Corporation.

HOSE CABINET

As per Sentence 3.2.9.4.(2), at each hose station, the hose connections, valves, fire hose, nozzle and hose rack are all to be in a hose cabinet (except in a Group F *occupancy*).

A hose cabinet is to be of sufficient size to contain the above equipment, contain a *listed* fire extinguisher, and provide sufficient clearance to permit the use of a standard fire department hose key as per Sentence 3.2.9.4.(4)..

HOSE STATION LOCATION

Hose stations are to be located as per Sentence 3.2.9.4.(5),

- so that every portion of the *building* can be reached by a hose stream within 3 m of a nozzle attached to the hose,
- not more than 5 m from every required *exit* serving a *floor area*, except for the *first storey* or if additional hose stations are required to achieve full coverage of the *floor area*, and
- in a conspicuous location where they are not likely to be obstructed.

HOSE STATIONS – EXITS AND EGRESS

Hose stations are to be located so that it is not necessary to penetrate an *exit* with a hose in order to provide the design coverage (Sentence 3.2.9.4.(6).

As per Sentence 3.2.9.4.(7), a hose is permitted to penetrate an *exit* in order to provide the required coverage to

- a *service room* referred to in Sentence 3.2.9.1.(4),
- a roof-top enclosure referred to in Sentence 3.2.9.1.(5),
- a room not more than 50 m^2 in area, or
- a room or group of rooms not more than 200 m^2 in area in a *sprinklered floor area*.

A hose station located on one side of a *horizontal exit* is to be considered to serve only the *floor area* on that side of the *horizontal exit* as per Sentence 3.2.9.4.(8).

Sentence 3.2.9.4.(9) requires that a hose cabinet is to be located so that its door, when fully opened, will not obstruct the required width of a *means of egress*.

SECURE AREAS AND LOCKABLE CABINETS

As per Sentence 3.2.9.4.(10), a hose station in a Group B, Division 1 *major occupancy* is permitted to be located in a secure area, or in a lockable cabinet provided that

- identical keys for all cabinets are located at all guard stations, or
- electrical remote release devices are provided and are connected to an emergency power supply.

STOP

EXAMPLE QUESTION

- Which one of the following is NOT required to be installed in a hose cabinet?
  a) a standard fire department hose key
  b) hose rack
  c) a *listed* fire extinguisher
  d) 38 mm diameter fire hose

OBC Reference ______________________________

EXERCISE #11-3

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. A *building* is 25 m (82 ft) high and requires a standpipe system. Which one of the following conditions meets the requirements of the OBC?
   a) a *building area* of 4000 m^2, no 65 mm connections
   b) a *building area* of 4310 m^2, 65 mm connections required
   c) a *building area* of 4000 m^2, no 38 mm connections
   d) a *building area* of 4310 m^2, no 65 mm connections

OBC Reference ______________________________

2. Which one of the following distances is the maximum coverage point from a hose cabinet location, when installed with the maximum length of hose?
   a) 30 m
   b) 38 m
   c) 33 m
   d) 65 m

OBC Reference ______________________________

3. Which of the following floor areas is a hose station located on one side of a *horizontal exit* permitted to serve?
   a) the *floor area* on either side of the *horizontal exit*
   b) a rooftop enclosure on the *storey* above.
   c) the first 5 m on either side of the *horizontal exit*
   d) only the *floor area* on that side of the *horizontal exit*

OBC Reference ______________________________

4. A hose station in a Group B, Division 1 *major occupancy* is permitted to be located in a secure area, or in a lockable cabinet provided which one of the following?
   a) electrical remote release devices are provided and are connected to an electrical power supply.
   b) identical fire department hose keys for all cabinets are located at all guard stations
   c) identical keys for all cabinets are located at all guard stations
   d) identical keys for all cabinets are located at all fire alarm pull stations

OBC Reference ______________________________

STOP

WATER SUPPLY FOR 38 MM HOSE CONNECTIONS

As required by Article 3.2.9.6., if a standpipe and hose system is required, the water supply is to be sufficient to provide a flow, measured at each of the two hydraulically most remote 38 mm diameter hose connections

- of not less than 380 L/min,
- for not less than 30 min,
- at a pressure of not less than 450 kPa, and
- of not less than 190 L/min from each of the two outlets simultaneously.

WATER SUPPLY FOR 65 MM HOSE CONNECTIONS

If 65 mm diameter hose connections are required, Article 3.2.9.7. requires that the water supply is to be sufficient to provide a flow, measured at each of the two hydraulically most remote 65 mm diameter hose connections

- of not less than 1 890 L/min,
- for not less than 30 min,

- at a pressure of not less than 450 kPa, and
- of not less than 945 L/min from each of the two outlets simultaneously.

A summary table of standpipe system design is given.

Building Height (m) or Building Area (m^2) (1)	38 mm Hose Connections	65 mm Hose Connections	Minimum Flow L/min (2)	Minimum Duration min	Minimum Pressure kPa	Flow per Outlet L/min
≤ 25 m and ≤ 4 000 m^2	Required	Not required	380	30	450	190
>25 m	Required	Required	1 890	30	450	945
>4 000 m^2	Required	Required	1 890	30	450	945

If the *building* is less than 84 m high, the required water supply may be supplied through the fire department connection.

If the *building* is 84 m or more high, the required water supply is to be provided by sufficient pumping capacity.

If the *building* is 84 m or more high, the *building* is to be served by not less than two sources of water supply from a public water system.

STOP

EXAMPLE QUESTION

- A *building* is 84 m high and requires a standpipe system. Which of the following water supply arrangements is required by the OBC?
  a) supplied through the fire department connection.
  b) provided by sufficient pumping capacity
  c) served by a source of water supply from a public water system
  d) minimum duration of 45 min

OBC Reference ______________________

EXERCISE #11-4

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. A *building* requires a standpipe system and a fire alarm system with an annunciator. Which one of the following conditions is required for the system to meet the requirements of the OBC?
   a) valves controlling standpipe water supplies are required to be chained and locked open
   b) valves controlling standpipe water supplies are required to have their handles removed in the open position
   c) hose valves are to be electrically supervised
   d) valves controlling standpipe water supplies are required to be equipped with an electrically supervised switch

OBC Reference ______________________________

2. When measuring flow and pressure to prove sufficient water supply to 38 mm or 65 mm hose connections, where are flow measurements taken?
   a) at the exterior fire department connection
   b) at each of the two hydraulically most remote hose connections
   c) at the nearest fire hydrant
   d) at the midpoint of the system

OBC Reference ______________________________

3. If a *building* requiring a standpipe system is 84 m (275 ft 7 in) high, what provision is required to conform to the OBC?
   a) water flow is permitted to be supplied through the fire department connection
   b) the water supply must be available for 45 minutes
   c) the building must be served by not less than two sources of water supply from a public water system
   d) supply must be supplemented by a private system

OBC Reference ______________________________

4. A *building* requires both sizes of hose connections. Which one of the following water supply flow capacities in L/s is required?
   a) 1890
   b) 945
   c) 450
   d) 380

OBC Reference ______________________________

STOP

Ontario

Ministry of Municipal Affairs and Housing

BUILDING SERVICES

PARTICIPANT'S MODULE #12

Safety and Accessibility within Floor Areas

JAN06

INTRODUCTION

In this module the concept of safety within floor areas is examined for relationships with building services. Hazardous substances storage and handling, exhaust ventilation, illumination, and other safety related aspects of rooms and spaces and reviewed along with the role of building services in maintaining a safe environment. Measures applicable to particular *occupancies* and those generally related to all *occupancies* are reviewed.

OBJECTIVES

Upon completion of this module participants will be able to:

- Understand the concept of safety within floor areas using building services;
- Understand the supply and exhaust air requirements for hazardous substances, equipment, and processes;
- Understand the requirements of barrier-free design on building services
- Understand the concept of integrity of exits and requirements for exit signs;
- Understand the supply and exhaust air requirements for protection of exits, aisles, and stages;
- Understand the supply and exhaust air requirements for care or detention occupancy and industrial occupancy;
- Understand the supply and exhaust air requirements for repair and storage garages and their vestibules;
- Understand the requirements of service facilities.

STOP

Hazardous Substances, Equipment and Processes

In accordance with Article 3.3.1.2., if hazardous substances are used in connection with the activities of any *occupancy* other than as permitted by Subsection 3.3.5. for a *high hazard industrial occupancy*, the storage, handling and use of the hazardous substances is to be in conformance with

- the Ontario Fire Code, or
- the National Fire Code of Canada, in the absence of regulations referred to in the Ontario Fire Code.

Cooking equipment, not within a *dwelling unit*, used in processes producing grease-laden vapours is to be designed and installed in conformance with Part 6. Heating, Ventilating and Air-Conditioning.

A fuel-fired *appliance* must not be installed in a corridor serving as an *access to exit*.

PROTECTION ON FLOOR AREAS WITH A BARRIER-FREE PATH OF TRAVEL

As per Article 3.3.1.7., except for sprinklered buildings, every *floor area* above or below the *first storey* that has a *barrier-free* path of travel is to be protected by one of the following options as follows:

Option 1: Each floor area is served **by an elevator**

- able to access every *storey* in conformance with 3.2.6.9. Elevator for Use by Firefighters,
- protected against fire in conformance with 3.2.6.9. Elevator for Use by Firefighters, and
- in a *building* over 3 *storeys* in *building height*, protected against smoke movement so that the hoistway will not contain more than 1% by volume of contaminated air from a fire floor during a period of 2 h after the start of a fire, assuming an outdoor temperature equal to the January design temperature on a 2.5% basis determined in conformance with Supplementary Standard, SB-1.

Option 2: Each floor area is divided into at least 2 zones **by *fire separations*** so that

- persons with physical disabilities can be accommodated in each zone,
- the travel distance from any point in one zone to a doorway leading to another zone must be not more than the value for travel distance permitted by Sentence

3.4.2.5.(1) for the *occupancy* classification of the zone, and

- a *barrier-free* path of travel is provided to an *exit*.

Exceptions

Option 3, in *residential occupancies*, the requirements that apply from Options 1 or 2 above are waived in accordance with Sentence 3.3.1.7.(2), if a **balcony is provided** for each *suite*, except for *suites* on the *storey* containing the *barrier-free* entrance described in Article 3.8.1.2. Entrances.

As noted above, all requirements are waived when the *building* is *sprinklered* as per Sentence 3.3.1.7.(4)..

Details of Option 2 where floor areas are divided "by fire separations"

The *fire separations* that divide the floor area are to have a *fire-resistance rating* not less than 1 h.

However, as per Sentence 3.3.1.7.(5), the *fire-resistance rating* of the *fire separations* referred is permitted to be less than 1 h but not less than 45 min provided the *fire-resistance rating* required by Subsection 3.2.2. Building Size and Construction Relative to Occupancy is permitted to be less than 1 h for

- the floor assembly above the *floor area*, or
- the floor assembly below the *floor area*, if there is no floor assembly above.

A door acting as a *closure* in the *fire separation* is to be weatherstripped or otherwise designed and installed to retard the passage of smoke in accordance with Sentence 3.3.1.7.(6).

Details of Option 3 "balcony is provided"

The balcony is to be

- provided with a doorway having a clear width not less than 800 mm when the door is open,

- not less than 1500 mm deep from the outside face of the exterior wall to the inside edge of the balcony, and
- provide not less than 0.5 m^2 for each occupant of the *suite*.

In addition, this balcony must be accessible by a barrier-free path of travel incorporating a maximum sill of 13 mm (Sentence 3.3.1.7.(7)).

EXHAUST VENTILATION

Article 3.3.1.19. states that an exhaust ventilation system designed in conformance with the appropriate requirements of Part 6 is to be provided in a *building* or part of a *building* in which dust, fumes, gases, vapour or other impurities or contaminants have the potential to create a fire or explosion hazard.

Explosion relief devices, vents or other protective measures conforming to Subsection 6.2.2. Ventilation, are to be provided for a space in which substances or conditions that have the potential to create an explosion hazard are present as a result of the principal use of a *building*.

VENTILATION REQUIREMENTS

All rooms and spaces are to be ventilated to conform with Part 6. Heating, Ventilating and Air-Conditioning

BARRIER-FREE DESIGN – CONTROLS

As per Article 3.8.1.5., controls for the operation of *building* services or safety devices, including

- electrical switches,
- thermostats, and
- intercom switches,

intended to be operated by the occupant and located in a *barrier-free* path of travel are to be accessible to a person in a wheelchair, operable with one hand and mounted between 900 and 1200 mm above the floor. Exception: as provided in Articles 3.5.2.2 and 3.8.3.5. Elevators (for elevators).

ILLUMINATION

All portions of a *barrier-free* path of travel are to be equipped to provide a level of illumination in accordance with Article 3.2.7.1. Minimum Lighting Requirements, as per Article 3.8.1.6.

EXITS – INTEGRITY OF EXITS

It is required by Sentence 3.4.4.4.(1) that a *fire separation* that separates an *exit* from the remainder of the *building* must have no openings except for

- standpipe and sprinkler piping,
- electrical wires and cables, totally enclosed *noncombustible* raceways and *noncombustible* piping that serve only the *exit*,
- openings required by the provisions of Subsection 3.2.6.,
- *exit* doorways, and
- wired glass and glass block permitted by Article 3.1.8.14.

A fuel-fired *appliance* must not be installed in an *exit* as per Sentence 3.4.4.4.(4).

As per Sentence 3.4.4.4.(5), an *exit* must not be used as a *plenum* for a heating, ventilating or air-conditioning system.

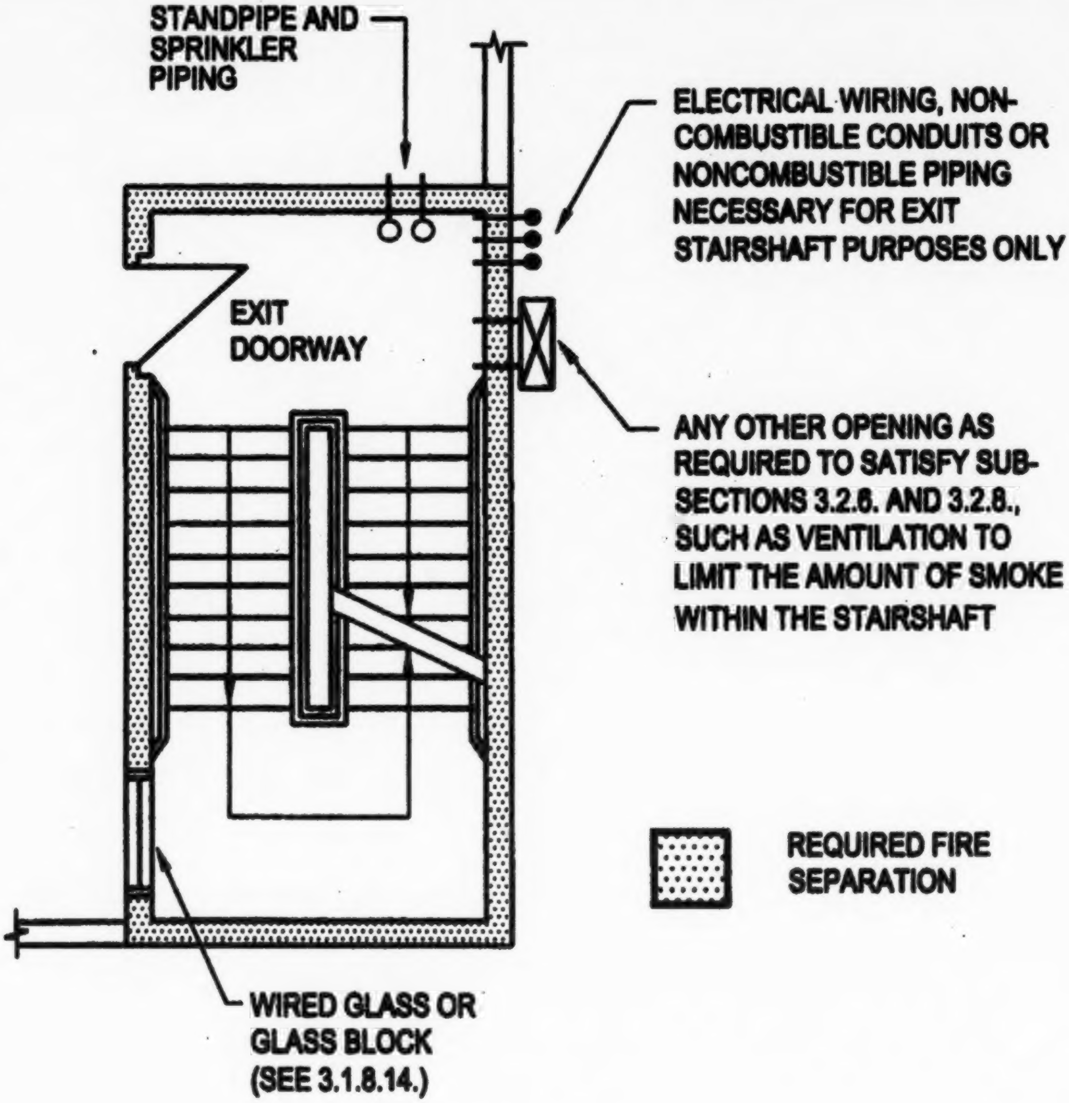

STANDPIPE AND SPRINKLER PIPING
ELECTRICAL WIRING, NON-COMBUSTIBLE CONDUITS OR NONCOMBUSTIBLE PIPING NECESSARY FOR EXIT STAIRSHAFT PURPOSES ONLY
EXIT DOORWAY
ANY OTHER OPENING AS REQUIRED TO SATISFY SUB-SECTIONS 3.2.6. AND 3.2.8., SUCH AS VENTILATION TO LIMIT THE AMOUNT OF SMOKE WITHIN THE STAIRSHAFT
REQUIRED FIRE SEPARATION
WIRED GLASS OR GLASS BLOCK (SEE 3.1.8.14.)

FIGURE 12-1

EXIT SIGNS

Every *exit* door is to have an *exit* sign placed over or adjacent to it as per Article 3.4.5.1. if the *exit* serves

- a *building* more than 2 *storeys* in *building height*,

- a *building* having an *occupant load* more than 150, or
- a room or *floor area* that has a fire escape as part of a required *means of egress*.

An *exit* sign is to be placed over or adjacent to every egress doorway from rooms with an *occupant load* more than 60 in Group A, Division 1 *occupancies*,

- dance halls,
- licensed beverage establishments, and
- other similar *occupancies* that,

when occupied, have lighting levels below that which would provide easy identification of the egress doorway. Exception: except for egress doorways described in Sentence 3.3.2.3.(4) for Fixed Seats.

Every *exit* serving a *hotel* is to have an *exit* sign placed over or adjacent to it. Exception: *suite* doors opening directly to the exterior.

As per Sentence 3.4.5.1.(2), every *exit* sign is to

- be visible from the *exit* approach,
- have the word EXIT or the words EXIT/SORTIE displayed in plain legible letters, and
- be illuminated continuously while the *building* is occupied.

If an *exit* sign having the word EXIT is installed, an additional sign displaying the word SORTIE is permitted.

As required by Sentence 3.4.5.1.(3), *exit* signs are to consist of red letters on a contrasting background or a red background with contrasting letters, with the letters having a 19 mm stroke and a height not less than

- 114 mm when internally illuminated, and
- 150 mm when externally illuminated.

If illumination of an *exit* sign is provided from an electrical circuit, that circuit is to

- serve no equipment other than emergency equipment, and
- be connected to an emergency power supply as described in Sentence 3.2.7.4.(1) of Emergency Power for Lighting

If necessary, Sentence 3.4.5.1.(5) requires that the direction of egress in *public corridors* and passageways is to be indicated by a sign with a suitable arrow or pointer indicating the direction of egress.

EXAMPLE QUESTION

Which one of the following is NOT allowed in a corridor serving as an access to exit?

a) an electric unit heater
b) a hot water space heater
c) a fuel-fired appliance
d) a steam radiator

OBC Reference ______________________________

EXERCISE #12-1

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. Which one of the following conditions requires cooking equipment to be designed and installed in conformance to Part 6 OBC?

a) stove-top grease-laden vapours within a dwelling unit

b) baking ovens in a grocery store accessible the public

c) commercial toasters located in a coffee shop
d) grease-laden vapours in a restaurant kitchen

OBC Reference ____________________________

2. In a four storey building, which one of the following correctly states the level of hoistway protection from smoke contaminated air for a barrier-free path of travel

a) not contain more than 1% by volume of contaminated air from a fire floor during a period of 2 h after the start of the fire.

b) not contain more than 2.5% by volume of contaminated air from a fire floor during a period of 2 h after the start of the fire

c) not contain more than 1% by volume of contaminated air from a fire floor during a period of 2.5 h after the start of the fire

d) an elevator is not a barrier-free path of travel

OBC Reference ____________________________

3. In barrier-free design, which one of the following correctly states the requirements for placement of controls for electrical switches, thermostats, intercom controls, etc?

   a) mounted more than 1 200 mm above the floor

   b) operable with one hand and mounted not more than 1 400 mm above the floor

   c) accessible to a person in a wheelchair

   d) accessible to a person in a wheelchair, operable with one hand and mounted not more than 1 200 mm above the floor

OBC Reference ______________________________

4. Which of the following conditions permits an exit sign to display the word "SORTIE" only?

   a) when used in a primarily French-speaking area of the Province

   b) in French immersion schools

   c) only in addition to an exit sign that displays the word "EXIT".

   d) under no condition

OBC Reference ______________________________

STOP

ASSEMBLY OCCUPANCY

Aisles

As per Article 3.3.2.4., dead -end aisles are permitted to be more than 10 m long, but not more than 13 m long if

- the seating area is separated from other seating areas and adjacent *occupancies*, including a corridor serving any seating area, by a *fire separation* in accordance with Sentences 3.3.2.2. (1) and (2) of Fire Separations,
- the travel distance is not more than 25 m measured along the path of travel from any seat to an *exit*, to an egress doorway or to an opening into a vomitory,
- at least one *means of egress*, comprising not less than 30% of the required *exit* capacity, is through an exterior *exit*, an *exit* stairway or a corridor not containing an *occupancy*,
- each row served by a dead-end aisle has a minimum unobstructed width of 400 mm plus 6.1 mm for each additional seat above 7 seats in a row, but not more than 550 mm,
- the activation of a *fire detector* or a sprinkler head in the seating area will cause the shutdown of the projection system serving the seating area and turn on the normal lighting in the seating area,
- a voice communication system is installed in conformance with Article 3.2.4.22. Voice Communication Systems,
- a smoke control system is installed to control movement of smoke in the seating area or a smoke exhaust system is provided so that, in the event of detection of smoke by a *smoke detector* in the seating area, air handling equipment is activated to extract air directly from the seating area at the rate of at least 6 air changes per hour, and
- the *floor area* is *sprinklered*.

Stages for Theatrical Performances

As required by Article 3.3.2.12., at least 2 vents for the purpose of venting fire and smoke to the outside of a *building* are to be provided above a *stage* designed for theatrical performances and are to

- have an aggregate area not less than one eighth of the area of the *stage* behind the proscenium opening, and
- be arranged to open automatically upon actuation of the sprinkler system.

CARE OR DETENTION OCCUPANCY

Protection for Special Care and Treatment Facilities

Article 3.3.3.6. requires compartments containing rooms such as operating rooms, recovery rooms, delivery rooms, intensive care units and critical care units, from which it is impracticable to move patients in an emergency, are to be

- separated from adjacent spaces by *fire separations* having a *fire-resistance rating* not less than 1 h, and
- provided with a mechanical air supply so that during a period of 2 h after the start of a fire in another space, the compartments will not contain more than 1% by volume of contaminated air from the fire area.

CONTAINED USE AREAS

As per Article 3.3.3.7., a *contained use area* is not required to be *sprinklered* provided

- the *building* is not required to be sprinklered,
- the *building* is designed so that during a period of 2 h after the start of a fire in the *contained use area*, other *fire compartments* will not contain more than 1% by volume of contaminated air from the *contained use area*,
- the *building* is designed so that during a period of 2 h after the start of a fire in another part of the building, the *contained use area* will not contain more than 1% by

volume of contaminated air from the other part of the *building*,

- all doors are designed to be remotely released in conformance with Sentence 3.3.1.12.(6), of Doors and Door Hardware and
- the *contained use area* does not contain any rooms lined with *combustible* padding.

INDUSTRIAL OCCUPANCY

Repair and Storage Garages

A garage is to be provided with natural or mechanical ventilation in conformance with the requirements of Subsection 6.2.2. Ventilation, to prevent excessive accumulation of carbon monoxide, exhaust fumes or flammable and toxic vapours as required by Article 3.3.5.4.

Vestibules

As per Article 3.3.5.7., if access is provided through a *fire separation* between a *storage garage* and a Group A1 or B *occupancy*, the access must be through a vestibule. If access is provided in a building more than 3 storeys high through a *fire separation* between a *storage garage* and a Group A Division 2, Division 3, Division 4 or Group C *occupancy*, the access must be through a vestibule.

If access is provided through a vestibule, the vestibule is to

- be not less than 1 800 mm long,
- be ventilated
  - naturally to outside air by a vent that has an unobstructed area of not less than 0.1 m^2 for each door that opens into the vestibule but not less than 0.4 m^2, or
- mechanically at a rate of 14 m^3/h for each square metre of vestibule floor surface area, and have openings between the vestibule and an adjoining *occupancy* provided with self-closing doors with no hold-open devices.

EXAMPLE QUESTION

- In the design of stages for theatrical performances two vents to the outdoors are to be provided above the stage area for the purpose of?

  a) rejection of heat from lighting
  b) venting fire and smoke from performances
  c) fresh air source for dilution of smoke
  d) venting fire and smoke and activated by the sprinkler system

OBC Reference ______________________________

EXERCISE #12-2

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. In the design of permitted dead-end aisles (10 m to 13 m long), which one of the following describes the behaviour of the required smoke control system?

   a) activated by heat detector extract air at 6 air changes per hour

   b) activated by smoke detector extract air at 6 air changes per hour

   c) activated by smoke detector supply air at 6 air changes per hour

   d) activated by smoke detector recirculate air at 6 air changes per hour

OBC Reference ______________________________

2. Which of the following conditions permits the use of a room lined with combustible padding in a contained use area?

   a) the door is designed to be remotely released

   b) the building is designed so that during period 2 h after the start of a fire in the contained use area, other compartments will not contain more than 1% by volume of contaminated air from the contained use area

   c) the building is required to be sprinklered

   d) combustible padding is not allowed in any contained use area

OBC Reference ______________________________

3. In a storage garage if access is provided through a fire separation to a Group A, B or C occupancy, which one of the following describes the requirements for the vestibule ventilation?

   a) rate of 14 ft3/h for each square metre

   b) rate of 14 m3/h for each square foot

   c) rate of 14 m3/h for each square metre

   d) mechanical venting not permitted

OBC Reference ______________________________

STOP

SERVICE ROOMS

Service Rooms under Exits

A *service room* containing service equipment subject to possible explosion, such as *boilers* operating in excess of 100 kPa (gauge) and some types of refrigerating machinery and transformers, must not be located directly under a required *exit* as per Article 3.6.2.2.

INCINERATOR ROOMS

A *service room* containing an incinerator must not contain other fuel-fired *appliances* as required by Article 3.6.2.4.

ELECTRICAL EQUIPMENT VAULTS

As per Article 3.6.2.7., where an electrical equipment vault is required by a regulation made under the *Electricity Act, 1998*, the electrical equipment vault is to be totally enclosed by a *fire separation* of solid masonry or concrete construction having a *fire-resistance rating* of

- not less than 3 h if the vault is not provided with an automatic fire extinguishing system and
- not less than 2 h if the vault is so protected.

Where a *building* is required to be *sprinklered*, the electrical equipment vault need not be *sprinklered* provided

- the vault is designed for no purpose other than to contain the electrical equipment, and
- a *smoke detector* is provided in the vault which will actuate the *building* fire alarm system in the event of a fire in the vault.

A vault, which is part of a *building* and houses electrical equipment indoors, is to have

- roofs or ceilings consisting of reinforced concrete of adequate strength for the conditions and not less than 150 mm thick, and

- floors consisting of reinforced concrete of adequate strength for the conditions and not less than 150 mm thick, except that floors which are at excavation level are permitted to be of reinforced concrete not less than 100 mm thick.

Walls, roofs or ceilings, and floors are to be adequately anchored together in a manner designed to resist dislodgement by explosion as per Article 3.6.2.7.

Only pipes or ducts necessary for fire protection or the proper operation of the electrical installation are to penetrate the *fire separations* surrounding the electrical equipment vault.

A ventilation duct or opening, which penetrates the *fire separation* to the outdoors, need not be protected by a *closure* at the penetration.

Each door to an electrical equipment vault is to be provided with a substantial lock or padlock.

Article 3.6.2.7. also requires explosion -relief devices and vents or other protective measures are to be provided for every electrical equipment vault containing dielectric liquid filled electrical equipment in conformance with Sentence 3.3.1.19.(2).

Exhaust Ventilation

Sentence 3.6.2.7.(9) requires every electrical equipment vault is to be provided with a ventilation system designed in conformance with Part 6 Heating, Ventilation and Air-Conditioning, to prevent the ambient temperature in the vault from exceeding 40°C.

As per Sentence 3.6.2.7.(10), where the vault ventilation system is directly from an outdoor area by natural ventilation without the use of ducts, and where the electrical equipment is the principal source of heat, the combined net area of inlet and outlet openings must be not less than 0.002 m^2/kVa of electrical equipment capacity with a minimum of 0.093 m^2, except that

- where equipment in the power class as described in CAN3-C88, "Power Transformers and Reactors" is installed, ventilation requirements are permitted to be based on the actual full-load losses, or
- where the equipment is installed for emergency purposes only and is not normally energized, it need not be considered in determining the ventilation requirements.

In the above vault ventilation system the inlet for fresh air is to lead from an outdoor area and is to terminate at a point not more than 1 000 mm above the floor level of the vault.

Sentence 3.6.2.7.(12) states that where the above vault ventilation system is a mechanical system, it is to be separate from the system for the remainder of the *building* and is to be designed so that

- the vault temperature is thermostatically controlled,
- the fan is located so that it may be serviced without danger to personnel,
- a high temperature alarm is provided in the vault,
- the system is automatically shut off in the event of a fire in the vault, and
- a filter is provided in the air inlet if there is a possibility of dirt being drawn in.

As per Sentence 3.6.2.7.(13), all ventilation openings are to be protected in conformance with Sentences 6.2.3.12.(3) and (4)and the protection is to be installed in such a manner that it cannot be removed from the outside by the use of common tools and it is tamperproof.

As required by Sentence 3.6.2.7.(14), the floor of an electrical equipment vault is to be liquid tight and surrounded by liquid tight walls and sills of sufficient height to confine within the vault all of the liquid from the largest item of electrical equipment, but to a height of not less than 100 mm.

Sentence 3.6.2.7.(15) provides an alternate: The floor of an electrical equipment vault may be provided with a floor drain connected to a covered sump. The sump is to be capable of holding all of the liquid from the largest item of electrical equipment, and the connection is to have a *noncombustible* trap to prevent the spread of fire from the vault to the sump.

VERTICAL SERVICE SPACES AND SERVICE FACILITIES

Exhaust Duct Negative Pressure

As per Article 3.6.3.4., if a *vertical service space* contains an exhaust duct that serves more than one *fire compartment*, the duct is to have a fan located at or near the exhaust outlet to ensure that the duct is under negative pressure.

HORIZONTAL SERVICE SPACES AND SERVICE FACILITIES

Plenum Requirements

As per Article 3.6.4.3. a concealed space used as a *plenum* within a floor assembly or within a roof assembly need not conform to Sentence 3.1.5.15.(1) (of Subsection Combustible Ducts)and Article 6.2.3.2. (Materials in Air Duct Systems) provided

- all materials within the concealed space have a flame-spread rating not more than 25 and a smoke developed classification not more than 50, except for
    - tubing for pneumatic controls,
    - optical fibre cables and electrical wires and cables that exhibit a flame spread not more than 1.5 m, a smoke density not more than 0.5 at peak optical density and a smoke density not more than 0.15 at average optical density when tested in conformance with the Flame and Smoke Test in the Appendix to CAN/CSA C22.2 No. 0.3, "Test Methods for Electrical Wires and Cables" (FT6 Rating),
    - optical fibre cables and electrical wires and cables that are located in totally enclosed *noncombustible* raceways,

  - totally enclosed nonmetallic raceways that exhibit a horizontal flame distance of not more than 1.5 m, an average optical smoke density of not more than 0.15, and a peak optical smoke density of not more than 0.5 when tested in conformance with the Test for Flame Propagation and Smoke Density Values in Section 3.3 of the Appendix to ULC/ORD-C2024, "Fire Tests for Optical Fibre Cable Raceway" (FT-6 Rating), and

  - single conductor electrical wires and cables that exhibit a vertical char of not more than 1.5 m when tested in conformance with the Vertical Flame Test – Cables in Cabletrough in Clause 4.11.4. of CSA C22.2 No. 0.3, "Test Methods for Electrical Wires and Cables" (FT4 Rating), and

- the supports for the ceiling membrane are of *noncombustible* material having a melting point not below 760°C.

If a concealed space referred above is used as a return-air *plenum* and incorporates a ceiling membrane that forms part of the required *fire-resistance rating* of the assembly, Article 3.6.4.3. requires every opening through the membrane is to be protected by a *fire stop flap* which is to

- stop the flow of air into the concealed space in the event of a fire,

- be supported in a manner that will maintain the integrity of the ceiling membrane for the duration of time required to provide the required *fire-resistance rating*, and

- conform to CAN4-S112.2-M, "Fire Test of Ceiling Firestop Flap Assemblies".

Asbestos paper must not be exposed in supply and return-air systems as per Sentence 3.6.4.3.(3)..

STOP

EXAMPLE QUESTION

- Which one of the following describes equipment types permitted to be located in a service room directly above a required exit?

  a) any equipment is permitted

  b) boilers operating below 100 kPa (ga

  c) boilers operating in excess of 100 kPa(gauge)

  d) refrigerating machinery subject to possible explosion

OBC Reference ______________________

EXERCISE #12-3

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. Electrical equipment vaults are to be maintained at a temperature not to exceed?

   a) 140°F

   b) 40°F

   c) 40°C

   d) 60°C

OBC Reference ______________________

2. Where an electrical equipment vault is provided with a mechanical ventilation system, the system design configuration in the event of a fire is?

   a) thermostatic control

   b) fan located to not endanger personnel

   c) air filter is provided

   d) system automatically shuts off

OBC Reference ______________________________

3. A concealed space may be used as a plenum provided all materials (with noted exceptions) have a flame spread rating and a smoke developed classification of?

   a) not more than 25 and not more than 50

   b) not more than 50 and not more than 25

   c) not more than 25 and more than 50

   d) more than 50 and not more than 50

OBC Reference ______________________________

STOP

Ontario

Ministry of Municipal Affairs and Housing

BUILDING SERVICES

FACILITATOR'S MODULE #13

Portable Classrooms and Self-Service Storage Buildings

JAN06

INTRODUCTION

In this module the requirements for fuel-fired appliances in portable classrooms are examined along with the building services components utilized in self-service storage buildings to aid in fire detection and fire fighting.

OBJECTIVES

Upon completion of this module participants will be able to:

- Understand the requirements of Fuel-Fired Appliances in Portable Classrooms;
- Understand the requirements of Building Services for Self-Service Storage Buildings.

STOP

PORTABLE CLASSROOMS

Fuel-Fired Appliances

As per Article 3.9.3.7., where there is only one egress door from a portable classroom, a fuel-fired *appliance* shall be separated from the remainder of the classroom by a *fire separation* with a *fire-resistance rating* of not less than 45 min.

If a portable classroom contains a fuel-fired *appliance*, the *appliance* shall be separated from the remainder of the classroom by a *fire separation* having a *fire-resistance rating* not less than

- 1.5 h where the horizontal distance between portable classrooms is 1500 mm or less, and

- 45 min where the horizontal distance between portable classrooms is more than 1500 mm.

Exceptions

As per Sentence 3.9.3.7.(3), if the horizontal distance between portable classrooms is 6 m or more, a fuel-fired *appliance* need not be separated from the remainder of the classroom by a *fire separation* provided

- there is not more than 1 *appliance* per portable classroom, and
- the *appliance* is located not less than 4.5 m from an *egress* doorway or an *exit* from the portable classroom.

Fuel-fired *appliances* with sealed combustion located in a portable classroom are not required to be separated from the remainder of the classroom as per Sentence 3.9.3.7.(4)

- if there are not more than four portable classrooms in a group, and
- if the *appliance* is located not less than 4.5 m from an egress doorway or an *exit* from the portable classroom.

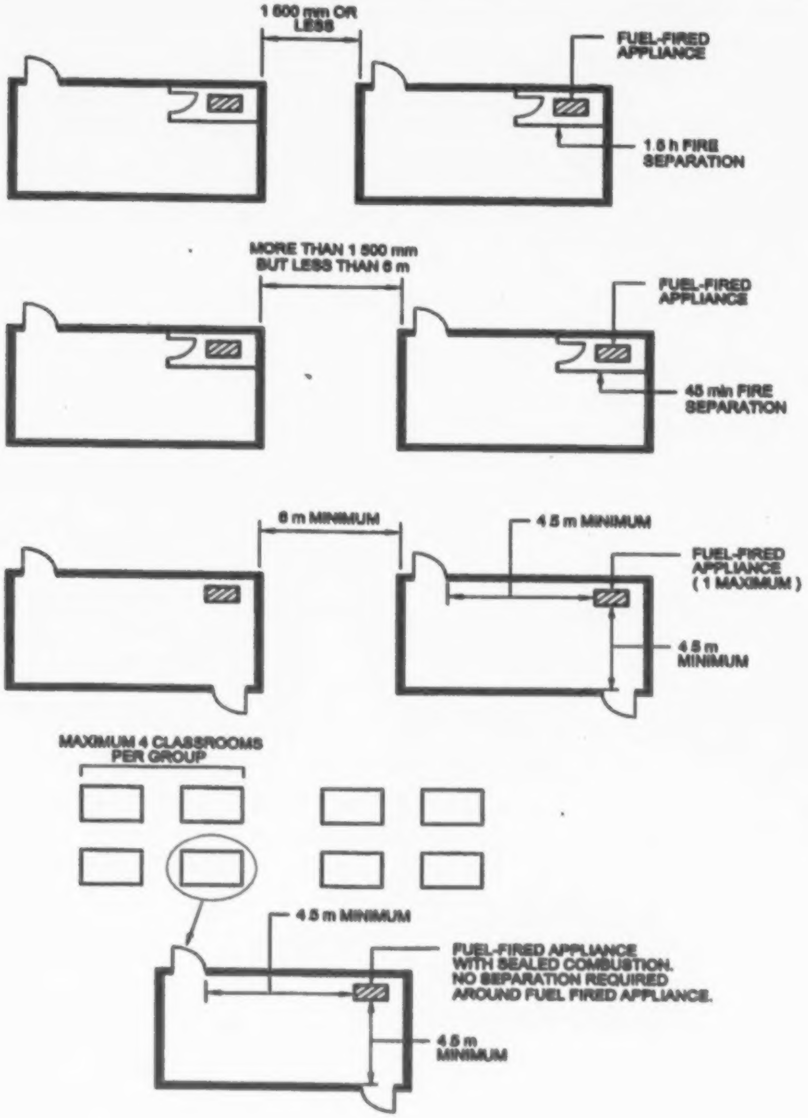

1 500 mm OR LESS
FUEL-FIRED APPLIANCE
1.5 h FIRE SEPARATION
MORE THAN 1 500 mm BUT LESS THAN 6 m
FUEL-FIRED APPLIANCE
45 min FIRE SEPARATION
6 m MINIMUM
4.5 m MINIMUM
FUEL-FIRED APPLIANCE (1 MAXIMUM)
4.5 m MINIMUM
MAXIMUM 4 CLASSROOMS PER GROUP
4.5 m MINIMUM
FUEL-FIRED APPLIANCE WITH SEALED COMBUSTION. NO SEPARATION REQUIRED AROUND FUEL FIRED APPLIANCE.
4.5 m MINIMUM

FIGURE 13-1

SELF-SERVICE STORAGE BUILDINGS

ADDITIONAL REQUIREMENTS FOR BUILDINGS CONTAINING MORE THAN 1 STOREY

Fire Alarm Systems

The requirements in Subsection 3.2.4. shall apply and a fire alarm system shall be installed. In addition;

Within the *first storey*, manual pull stations are required only in corridors, as per Article 3.10.3.3.

Provisions for Fire Fighting

In accordance with Article 3.10.3.4., the requirements in Subsection 3.2.5. shall apply. In addition;

Access routes for fire department vehicles shall be provided and shall be not less than 9 m wide.

Hydrants shall be located in the access routes required above so that

- for a *building* provided with a fire department connection for a standpipe system or a sprinkler system
    - a fire department pumper vehicle can be located adjacent to a hydrant, and
    - the unobstructed path of travel for the firefighter from the vehicle to the fire department connection is not more than 45 m, and
- for a *building* which is not *sprinklered*, a fire department pumper vehicle can be located in the access route so that the unobstructed path of travel for the firefighter is not more than
    - 45 m from the hydrant to the vehicle, and
    - 45 m from the vehicle to every opening in the *building*.

Standpipe Systems

As per Article 3.10.3.5., the requirements in Subsection 3.2.9. shall apply. In addition;

Hose stations are not required in the *first storey*.

ADDITIONAL REQUIREMENTS FOR 1 STOREY BUILDINGS

Fire Alarm Systems

As per Article 3.10.4.4., the requirements in Subsection 3.2.4. shall not apply, except;

The requirements for *smoke alarms* in Article 3.2.4.21. shall apply to a *dwelling unit*.

Provisions for Fire-fighting

In accordance with Article 3.10.4.5., the requirements in Subsection 3.2.5. shall not apply, except;

Access routes for fire department vehicles shall be provided and shall be not less than 9 m wide.

Hydrants shall be located in the access routes required in Sentence (2) so that the locations conform to Sentence 3.10.3.4.(3).

The access routes required in Sentence (2) shall conform to the requirements in Sentence 3.2.5.6.(1).

An adequate water supply for fire-fighting shall be provided for every *building*.

Where a sprinkler system is installed, the system shall conform to the requirements in Articles 3.2.5.13., 3.2.5.16. and 3.2.5.18.

Where *combustible* sprinkler piping is installed, it shall conform to the requirements in Article 3.2.5.14.

STOP

EXAMPLE QUESTION

- A portable classroom that is part of a group of four contains a fuel-fired *appliance* separated from the remainder of the classroom by a *fire separation* with a *fire-resistance rating* of 45 min and has only one egress. Which one of the following conditions is an exception allowing the deletion of the fire separation?
  a) fuel-fired *appliances* must be sealed combustion type not less that 4.5 m from egress
  b) no exception allowed with only one egress door
  c) portables must be most be more than 6 m apart
  d) portable door must be 1 100 mm width

OBC Reference ______________________________

EXERCISE #13-1

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. Regarding self-service storage *buildings* of 1 *storey*, which one of the following is a requirement of the OBC regarding fire alarms for this use?
   a) an annunciator panel
   b) a main control unit
   c) *smoke alarms*
   d) 3.2.4. shall not apply

OBC Reference ______________________________

2. A portable classroom has two means of egress, and a natural draft fuel-fired *appliance* located 5 m from each of the exit doorways. The horizontal distance to the next portable is 1500 mm. What is the *fire-resistance rating* of the required *fire separation* between the *appliance* and the rest of the classroom?
    a) no rating required, only a group of two
    b) 45 min
    c) 1.5 h
    d) 30 min

OBC Reference ______________________________

3. Which one of the following is NOT a requirement for provisions for fire fighting for self-service storage *buildings* containing more than 1 *storey*?
    a) if fire department connections connected, maximum 45 m travel (unobstructed)
    b) access routes not less than 9m wide
    c) hydrants
    d) access route not less than 3 m nor more than 15 m away

OBC Reference ______________________________

STOP

Ontario

Ministry of Municipal Affairs and Housing

BUILDING SERVICES

PARTICIPANT'S MODULE #14

Public Pools and Spas

JAN06

INTRODUCTION

The OBC requirements of building services for public pools and spas are examined and explored. Recirculation systems, drain fittings, dressing room facilities, emergency lightning, power, and communication and address systems are reviewed for both public pools and spas.

OBJECTIVES

Upon completion of this module participants will be able to:

- Understand the OBC definition of Public Pools;
- Understand the different pool types and their requirements of Building Systems;
- Understand the scope and application of Public Spas;
- Understand the requirements of Building Systems for Public Spas.

STOP

PUBLIC POOLS

Application

Applies to every *public pool*.

Applies to the design and construction of site assembled and manufactured pools that are intended for use as *public pools*.

As per Article 3.11.1.1., where material alterations to a *public pool* or the equipment installed in a *public pool* affect the bottom slope, the water volume or the capacity of the *recirculation system*, the adversely affected portions are to comply with the requirements of the OBC.

Where material alterations or repairs concern any pool fitting passing water and/or air in or out of the pool tank, the affected fitting is to comply with Sentences 3.11.8.1.(14) to (20) (of Subsection Recirculation Systems).

POOL AND POOL DECK DESIGN AND CONSTRUCTION REQUIREMENTS FOR ALL CLASS A AND CLASS B POOLS

Construction Requirements (Article 3.11.3.1.)

Perimeter drainage is to be provided where necessary to prevent surface run-off from draining onto the *pool deck*.

Except for a *modified pool*, one or more hose bibs are to be installed near the perimeter of the *pool deck* in locations convenient for flushing the *pool deck*.

Where access to the pool enclosure is over any surface that is not subject to regular cleaning and sanitizing, a foot spray to wash feet by means of a spray running freely to waste is to be provided at each access (except for a *modified pool* and *wave action pool)*.

RECIRCULATION FOR PUBLIC POOLS

Recirculation Systems

As per Sentence 3.11.8.1.(1), every *public pool* is to be equipped with a *recirculation system*.

Not Potable Water

The water in a *public pool* and its *recirculation system* is to be deemed not to be *potable* water.

As per Sentence 3.11.8.1.(3), the water in a *public pool* and its *recirculation system* is to be separated from the *potable* water supply and from the sewer or drainage system into which it drains by air gaps or other devices that prevent

- the water in the pool or its *recirculation system* from flowing back into the *potable* water supply, and
- the water in the sewer or drainage system from flowing back into the pool or its *recirculation system*.

Circulation Rates (Sentence 3.11.8.1.(5))

The *recirculation system* of a *public pool* is to be capable of filtering, disinfecting and passing through the pool each day a volume of water based on the following:

For a Class A Pool

Other than a *modified pool* or a *wave action pool*, six times the total water volume of the pool.

For a Class B Pool

Other than a *wave action pool*, four times the total water volume of the pool.

For a *modified pool*

Three times the total water volume of the pool

For a *wave action pool*

Six times the total water volume of the pool.

MAKE-UP WATER

A *recirculation system* is to be equipped with a flow meter registering the rate of water flow in accordance with Sentence 3.11.8.1.(6).

As per Sentence 3.11.8.1.(7), all pools are to be provided with automatic *make-up water* devices and provided with water meters to register the volume of all *make-up water* added to a *public pool* or its *recirculation system*.

Disinfection

Sentence 3.11.8.1.(8) requires equipment is to be installed to continuously disinfect the water in a *public pool* by means of

- a chlorination or hypochlorination system provided with a chemical controller for regulating the dosage of chlorine and capable of providing not less than
  - in the case of an *outdoor pool*, other than a *wave action pool*, 300 g of chlorine per day per 10,000 L of total pool capacity,
  - in the case of an indoor pool, other than a wave action pool, 200 g of chlorine per day per 10,000 L of total pool capacity,

- in the case of an outdoor wave action pool, 1200 g of chlorine per day per 10,000 L of total pool capacity, and
- in the case of an indoor wave action pool, 800 g of chlorine per day per 10,000 L of total pool capacity, or
- a bromination system capable of maintaining in the pool water a total bromine residual of 3 mg/L.

Chlorination equipment for a *public pool* is to contain a mechanism whereby the chlorine feed is to automatically terminate whenever the *recirculation system* ceases to supply *clean water* to the pool.

SKIMMERS

As per Sentence 3.11.8.1.(9) except for a *modified pool* and *wave action pool*, a *public pool* is to be equipped with overflow gutters or surface skimmers connected to the *recirculation system* that are capable

- of removing surface film from the surface of the water, and
- withdrawing each day and discharging to the waste drains up to 15% of the total volume of pool water.

INLETS

A *public pool* is to be equipped with *clean water* inlets arranged in conjunction with surface skimmers or overflow gutters to provide uniform distribution and circulation of *clean water* as stated in Sentence 3.11.8.1.(13).

OPENING SIZES

All fittings at or below the water surface that allow water and/or air to be passed to or from the *public pool* are required by Sentence 3.11.8.1.(14) to

- have a maximum opening of 7 mm in one direction, and
- be securely held in place by corrosion resistance fastening that require a tool for removal and are

galvanically compatible with the fittings and grilles or covers.

Exception: Fittings returning water and/or air to the pool tank that are located within 300 mm of the water surface are permitted to have openings with one dimension more than 7 mm but must contain no openings more than 25 mm in diameter.

Except for a modified pool, Sentence 3.11.8.1.(15) requires all fittings below the water surface that provide suction or gravity flow in a public pool are to

- be provided with a minimum of two suction or gravity outlets interconnected to a full size manifold, and
- be separated by a clear distance of not less than 1200 mm.

Except for a *modified pool*, water in all *public pools* is to be capable of being emptied through the pool drains in twelve hours or less.

Except for a *modified pool*, openings in suction or gravity fittings are to

- be such that the flow of water does not exceed 0.45 m/s and the velocity is calculated assuming all possible sources of suction flow are present at one time, and
- be such that every suction fitting located within 1000 mm of the water surface, except for skimmers and gutter fittings, contain openings with a minimum aggregate area of 0.2 m^2.

General Note For a Modified Pool

A *modified pool* is to be provided with two or more drain fittings covered with protective grilles with openings having an aggregate area of at least 10 times the internal cross-sectional area of the outlet pipe or pipes connected to the *recirculation system*. Drain fittings are to be located so they are capable of completely draining the pool.

Colour Marking

As per Sentence 3.11.8.1.(10), all exposed *potable* water piping and chlorine piping within a *public pool* water treatment *service room* is to be colour coded by means of

- painting the entire outer surface of the piping, or
- coloured bands at least 25 mm in width that are spaced along the piping at intervals of not more than 1200 mm.

The colour coding referred is to be yellow for chlorine and green for *potable* water.

Except for skimmers and gutters, Sentence 3.11.8.1.(18) requires all submerged suction and gravity fittings are to be clearly and permanently marked with a 50 mm wide band in a contrasting colour.

Restricted Fittings

Submerged skimmer equalizer fittings and vacuum fittings are not permitted in *public pools* as stated in Sentence 3.11.8.1.(20).

STOP

EXAMPLE QUESTION

- Where access to the pool enclosure (except modified pool and wave action pool) is over any surface that is not subject to regular cleaning and sanitizing, which one of the following provisions is required?

  a) potable water bath

  b) a foot spray running freely to waste

  c) a foot cleaning mat

  d) access to be chemically cleaned daily

OBC Reference ______________________________

EXERCISE #14-1

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. The recirculation system of a public pool is to be capable of filtering, disinfecting and passing through the pool each day a volume of water. What is the rate required for modified pool?

    a) three times the total water volume of the pool

    b) six times the total water volume of the pool

    c) four times the total water volume of the pool

    d) two times the total water volume of the pool

OBC Reference ______________________________

2. Disinfection rates vary upon the type of public pool, which one of the following is the rate (not less than) for an outdoor wave action pool?

    a) chlorine 300 g per day per 10 000 L total pool capacity

    b) chlorine 800 g per day per 10 000 L total pool capacity

    c) chlorine 200 g per day per 10 000 L total pool capacity

    d) continuous bromine residual of 3 mg/L

OBC Reference ______________________________

3. Under what condition are fittings at or below the water surface of a pool allowed to have a maximum opening greater than 7 mm in one direction?

   a) when secured in place by corrosion resistance fastening

   b) when they are galvanically compatible

   c) when they are located within 300 mm of the water surface

   d) when they require a tool for removal

OBC Reference ____________________________

4. All exposed potable water piping and chlorine piping within a public pool water treatment service room is to be colour coded. Which one of the following is the correct coding for chlorine piping and potable water piping?

   a) chlorine – green, potable water – blue

   b) chlorine – yellow, potable water – blue

   c) chlorine – red, potable water – green

   d) chlorine – yellow, potable water – green

OBC Reference ____________________________

STOP

DRESSING ROOMS, LOCKER FACILITIES, AND PLUMBING FACILITIES FOR ALL PUBLIC POOLS

Dressing Rooms and Sanitary Facilities

In accordance with Article 3.11.9., every *public pool* is to be equipped with dressing rooms, locker rooms, shower heads, water closets, urinals, lavatories and drinking fountains which are to be designed, constructed and equipped to comply with the following.

Fixtures

As per Sentence 3.11.9.1.(4), the minimum number of water closets, urinals and lavatories are to be determined from Article 3.7.4.3. and Table 3.7.4.3.C. (of 3.7.4. Plumbing Facilities) for an *occupant load* based on

- the formula in Sentence 3.1.17.3.(1) (of 3.1.17. Occupant Load) for all *public pools*, except a *wave action pool*, or

- the formula in Sentence 3.1.17.3.(2) (of 3.1.17. Occupant Load) for a *wave action pool*.

Showers

A minimum of one shower head is to be provided for every 40 bathers as required by Sentence 3.11.9.1.(5).

Where dressing and locker rooms, water closets and urinals are provided in conjunction with a *public pool*, it is required by Sentence 3.11.9.1.(6) that they are to be located in such a manner that bathers, after using them, are to pass through or by a shower area to reach the *pool deck*.

All shower heads are to be supplied with *potable* water at a pressure of at least 140 kPa in accordance with 3.11.9.1.(7).

The shower water system is to have one or more tempering devices capable of being adjusted to ensure that water supplied to shower heads does not exceed 40°C.

Floors and Partitions

Sentence 3.11.9.1.(9) requires floors in washrooms, shower areas and passageways used by bathers to slope to waste drains at not less than 1% and to be of hard surfaced materials that do not become slippery when wet. Joints between floors and walls are to be coved in these areas and in dressing and locker rooms.

Hose bibs are to be provided in safe locations convenient for flushing down the walls and floors in washrooms, shower areas and passageways used by bathers.

Partitions or walls are to be provided as per Sentence 3.11.9.1.(12) to ensure privacy of dressing rooms, washrooms and shower areas.

The bottom of interior *partitions* in dressing rooms and washrooms are to be between 250 mm and 350 mm above the floor.

Dressing and locker room floors are to have non-slip surfaces that permit convenient and thorough cleaning and disinfecting.

Exceptions for Dressing Rooms and Sanitary Facilities

As per Sentence 3.11.9.1.(2), where a Class A pool is installed on the premises of a *recreational camp*, dressing rooms, locker rooms, shower heads, water closets, urinals, lavatories and drinking fountains are not required if

- dressing, water closet and shower facilities are conveniently available for bathers elsewhere on the premises, and
- where access to the pool enclosure is over any surface that is not subject to regular cleaning and sanitizing, a foot spray to wash feet by means of a spray running freely to waste is to be provided at each access.

Where a Class B pool is installed, Sentence 3.11.9.1.(3) states that dressing rooms, locker rooms, shower heads, lavatories, water closets, drinking fountains and urinals are not required if

- dressing, water closet and shower facilities are conveniently available elsewhere on the premises for bathers when the pool is open for use, and
- where access to the pool enclosure is over any surface that is not subject to regular cleaning and sanitizing, a foot spray to wash feet by means of a spray running freely to waste is to be provided at each access.

EMERGENCY PROVISIONS FOR ALL PUBLIC POOLS

Lighting and Emergency Provisions

Rooms and spaces used by the public in conjunction with a *public pool* are to be capable of illumination to levels in compliance with Subsection 3.2.7. Lighting and Emergency Power Systems as stated in Article 3.11.10.1.

Exceptions

Dressing rooms, locker rooms, shower rooms, washrooms and passageways are to have an illumination level of at least 200 lx at floor level as per Sentence 3.11.10.1.(2). As stated in Sentence 3.11.10.1.(3), an *indoor pool* or an *outdoor pool* that is intended to be open for use after sundown is to be equipped with a lighting system

- that will maintain at any point on the *pool deck* and on the pool water surface an illumination level of at least,
- 200 lx in the case of an *indoor pool*, and
- 100 lx in the case of an *outdoor pool*, and
- that makes the underwater areas of the pool clearly visible from any point on the *pool deck*.

Night Use and Emergency Power

An *outdoor pool* that is intended to be open for use after sundown and an *indoor pool* are to be equipped with an independent emergency lighting system that automatically operates whenever the normal electrical power supply to a *public pool* lighting system fails as per Sentence 3.11.10.1.(4).

Sentence 3.11.10.1.(5) requires the independent emergency lighting system is to be capable of illuminating the *pool deck*, washroom, shower, locker areas, pool water surface and all means of egress to a level of at least 10 lx.

An emergency power supply for the emergency lighting system is to comply with Sentences 3.2.7.4.(1) and 3.2.7.7.(1) and Article 3.2.7.5. (of Subsection 3.2.7. Lighting and Emergency Power Systems).

Communication and Address Systems

An emergency telephone directly connected to an emergency service or to the local telephone utility is to be installed adjacent to the *pool deck* of every Class A pool as required by Sentence 3.11.10.1.(7).

Sentence 3.11.10.1.(8) requires a telephone accessible for emergency use to be installed for every Class B pool within 30 m of the pool.

Every *wave action pool* is to have a public address system which is to be clearly audible in all portions of the pool to be in accordance with Sentence 3.11.10.1.(9).

As required by Sentence 3.11.10.1.(10), every *wave action pool* is to have a communication system for the use of persons engaged in supervision or operation of the pool which is to be interconnected with each lifeguard control station, the first-aid room and the bather admission control centre.

The above public address system and the communication system are to be interconnected as per Sentence 3.11.10.1.(11).

Emergency Stop

Sentence 3.11.10.1.(12) requires all recirculating pumps used in a *public pool* are to be capable of being deactivated by an emergency stop button clearly labelled and located at

- a Class A pool beside the emergency telephone, and
- a Class B pool on the deck area.

The emergency stop button, when used, is to activate an audible and a visual signal located by the emergency stop.

An emergency sign containing the words **IN THE EVENT OF AN EMERGENCY PUSH EMERGENCY STOP BUTTON AND USE EMERGENCY PHONE, AUDIBLE AND VISUAL SIGNAL WILL ACTIVATE** are to be in letters at least 25 mm high with a 5 mm stroke and posted above the emergency stop button as per Sentence 3.11.10.1.(14).

Service Rooms and Storage for all Public Pools

In addition to the requirements of this Subsection, *service rooms* are to comply with the requirements of Sentences 3.6.2.1.(5), 3.6.2.1.(7) and 3.6.2.1.(8) and Articles 3.5.3.3. and 3.6.2.2. (of 3.5.3.3. Fire Separations for Elevator Machine Rooms and 3.6 Service Facilities)

Article 3.11.11.1. requires that where compressed chlorine gas is used as a pool water disinfectant, the cylinders or containers of gas are to be located in a *service room* that

- except as provided in Sentences 3.1.9.4.(3) to (8) (of 3.1.9.4. Combustible Piping Penetrations), is separated from the remainder of the *building* by a 1 h *fire separation* that is substantially gas tight,
- is designed for the sole purpose of containing all installed pressurized chlorine gas apparatus and piping and storing all chlorine gas containers or chlorine gas cylinders that are individually secured against toppling,
- is located at or above ground level,
- is provided with an *exit* door opening to the outdoors,
- has screened openings to the outdoors with at least one opening located within 150 mm from the floor and at least one opening located within 150 mm from the ceiling, each opening being 2% of the area of the floor,

- is equipped with emergency mechanical ventilation capable of producing at least 30 air changes per hour, taking suction at a maximum of 900 mm above the floor level and discharging at least 2500 mm above ground level directly to the outdoors, and
- contains a platform weigh scale of at least 135 kg capacity for each chlorine cylinder in use.

Storage facilities are to be provided for the safe storage of all chemicals required in pool operations.

The storage facilities are to be ventilated and are to be equipped with a water hose connection and a floor drain.

Service rooms and storage facilities, including rooms and facilities that contain electrical or mechanical equipment or chemicals or chemical feeders, are to be equipped with a secure locking device.

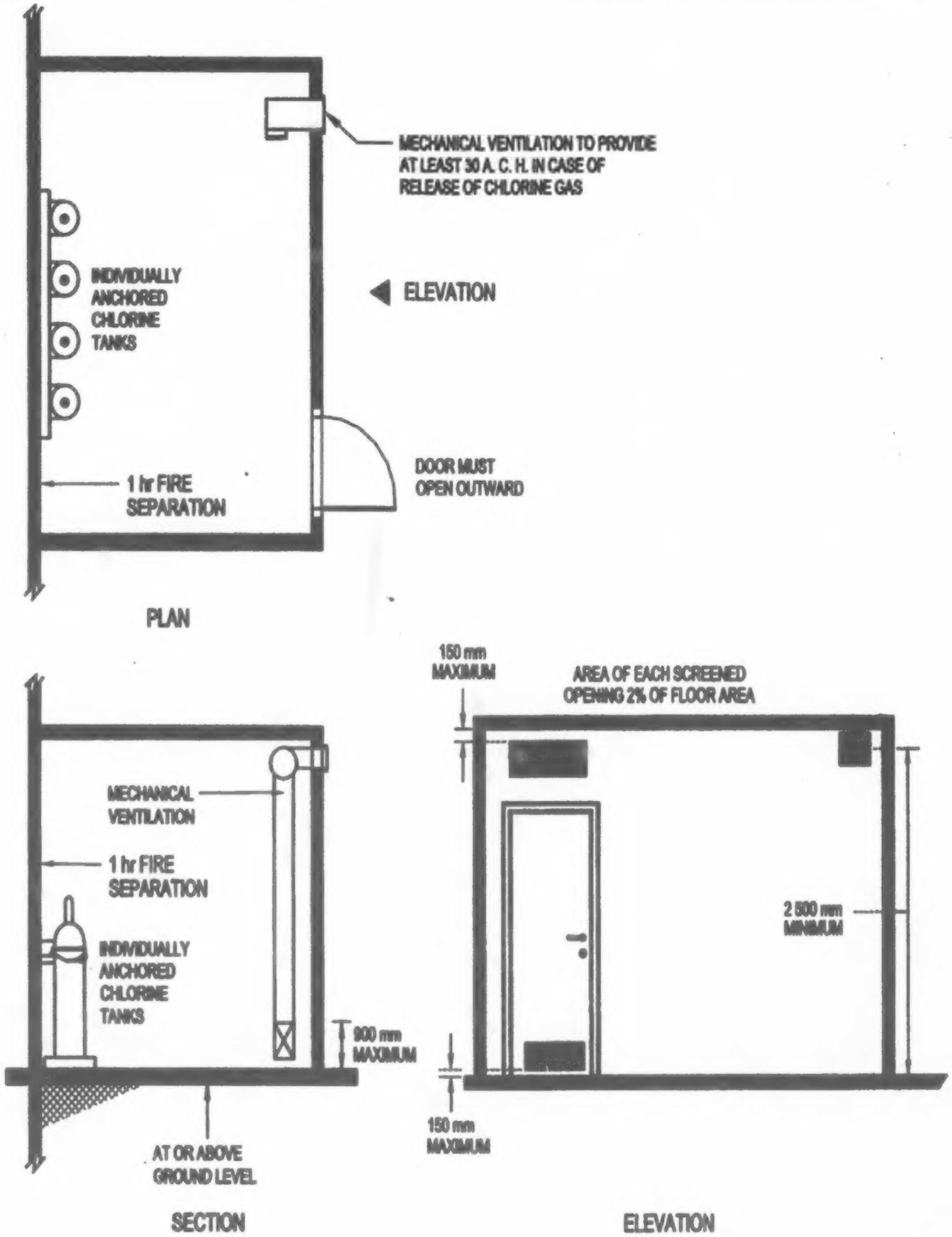

MECHANICAL VENTILATION TO PROVIDE AT LEAST 30 A. C. H. IN CASE OF RELEASE OF CHLORINE GAS
INDIVIDUALLY ANCHORED CHLORINE TANKS
ELEVATION
DOOR MUST OPEN OUTWARD
1 hr FIRE SEPARATION
PLAN
MECHANICAL VENTILATION
1 hr FIRE SEPARATION
INDIVIDUALLY ANCHORED CHLORINE TANKS
900 mm MAXIMUM
AT OR ABOVE GROUND LEVEL
SECTION
150 mm MAXIMUM
AREA OF EACH SCREENED OPENING 2% OF FLOOR AREA
2 500 mm MINIMUM
150 mm MAXIMUM
ELEVATION

FIGURE 14-1

STOP

EXAMPLE QUESTION

- Which one of the following correctly describes the condition where an indoor pool is required to be equipped with a lighting system?

    a) it contains a public viewing area

    b) where emergency power is available

    c) all indoor pools require a lighting system

    d) where bather load is over 25

OBC Reference ______________________

EXERCISE #14-2

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. Which type of pool requires an emergency telephone directly connected to an emergency service or to the local telephone utility to be installed adjacent to its pool deck?

    a) Class B modified pool

    b) Class A pool

    c) Class B pool

    d) all pools

OBC Reference ______________________

2. Which system actions are required after activation of an emergency stop button designed for a Class A and Class B pool?

   a) visual and audible signal

   b) visual and audible signal and deactivation of recirculation pumps

   c) deactivation of recirculation pumps

   d) audible signal and deactivation of recirculation pumps

OBC Reference ______________________________

3. Compressed chlorine gas is used as a pool water disinfectant and the cylinders of gas are to be located in a service room that is 2 m long by 2 m wide and 2.5 m high. What is the minimum capacity of the emergency mechanical ventilation fan in m3/min?

   a) 0.5

   b) 5.0

   c) 6.0

   d) 60.0

OBC Reference ______________________________

STOP

PUBLIC SPAS

Application

Section 3.12. applies Section applies to the design and *construction* of site-assembled *public* spas and factory-built *public* spas.

If material alterations to a *public spa* or the equipment installed in a *public spa* affect the bottom slope, the water volume or the capacity of the water circulation system, the adversely affected portions are to comply with the requirements of the OBC.

If material alterations or repairs concern any pool fitting that passes water or air, or both, in or out of the pool tank, the affected fitting are to comply with Sentences 3.11.8.1.(20) (of 3.11.8. Recirculation for Public Pools) and 3.12.4.1.(4) to (10). (of 3.12.4 Water Circulation for public Spas)

Exception: If the material alterations or repairs concern a fitting cover or grille, the affected fitting cover or grille is to comply with Sentences 3.12.4.1.(7) to (10) (of 3.12.4 Water Circulation for Public Spas).

Reference Equivalency

As per Sentence 3.12.1.1.(5), every reference to a *public pool* or a *recirculation system* in a definition in Article 1.4.2.1. of Division A, or a Sentence or Clause in Section 3.11. that is made applicable to *public spas*, is to be deemed to be a reference to a *public spa* or water circulation system, respectively.

WATER CIRCULATION FOR PUBLIC SPAS

In addition to the following requirements, the water circulation system of a *public spa* is to comply with the requirements of Sentences 3.11.8.1.(2), (3), (6), (7), (9), (10), (11), (13) and (20). (of 3.11.8. Recirculation for Public Pools)

As per Sentence 3.12.4.1.(2), a *public spa* is to be equipped with a water circulation system that is capable of filtering, disinfecting and passing the *public spa* water through the *public spa* with a turnover period of not more than

- 30 minutes for a *public spa* with a volume of water that exceeds 6 m^3,
- 20 minutes for a *public spa* with a volume of water that exceeds 4 m^3 but does not exceed 6 m^3, or
- 15 minutes for a *public spa* with a volume of water that does not exceed 4 m^3.

If cartridge-type filters are used for a *public spa*, the filters are to be a surface-type that is designed for a maximum flow rate of 0.27 L/s/m^2 of effective filter area as per Sentence 3.12.4.1.(3).

Suction or Gravity Outlets

Sentence 3.12.4.1. (4) requires every circulation system in a *public spa* to be served by a minimum of two suction or gravity outlets

- that are interconnected to a full size manifold, and
- that are separated by a clear distance of not less than 900 mm.

Exception: As per Sentence 3.12.4.1.(5), if compliance is impracticable because of dimensional restrictions at the bottom of the *public spa*, the outlets may be located on two different planes of the *public spa* if

- at least one of the outlets through which the *public spa* can be emptied to a full-size manifold is located on the bottom of the *public spa*, and
- the bottom of all outlets, other than skimmers, are not more than 75 mm from the floor of the *public spa*.

Exception: A circulation system in a factory-built *public spa* may be served by a built-in suction or gravity outlet with multiple openings that are connected to a full-size manifold, as per Sentence 3.12.4.1.(6).

Fittings Below Water

All fittings at or below the water surface that allow water or air or both to be passed to or from the *public spa* are to be securely held in place by corrosion resistant fastening that requires a tool for removal and is galvanically compatible with the fittings and grilles or covers as stated in Sentence 3.12.4.1.(7).

As required by Sentence 3.12.4.1.(8), all suction or gravity fittings installed at or below the water line of a *public spa* are to

- have a maximum opening of 7 mm in one direction, and
- be designed so that the flow of water through the openings does not exceed 0.45 m/s.

Exception: As per Sentence 3.12.4.1.(9), this does not apply to suction and gravity outlets which are equipped with anti-entrapment covers that comply with the requirements of ANSI/ASME A112.19.8M, "Suction Fittings for Use in Swimming Pools, Wading Pools, Spas, Hot Tubs, and Whirlpool Bathtub Appliances".

The calculation of water velocities and the calculation of water flow rates are to be based on the assumption that all possible sources of suction flow are present at the same time in accordance with Sentence 3.12.4.1.(10).

The water velocity in a suction pipe must not exceed 1.8 m/s.

- Sentence 3.12.4.1.(12) requires that the water velocity in a pressure pipe not exceed3.0 m/s for plastic piping, and
- 1.8 m/s for copper piping.

Every suction system that serves a *public spa* is to be equipped with a vacuum relief mechanism which is to include

- a vacuum release system,

- a vacuum limit system, or
- other engineered systems which are designed, constructed and installed to conform to good engineering practice appropriate to the circumstances as per Sentence 3.12.4.1.(13).

Water Disinfection

Equipment is to be installed to continuously disinfect the water in a *public spa* by means of a chlorination, hypochlorination or bromination system that is capable of regulating the dosage of chlorine or bromine as required by Sentence 3.12.4.1.(14).

As stated in Sentence 3.12.4.1.(15), if a two-speed pump is utilized for a *public spa*, the filter and heater are to be sized to accommodate the maximum pump output, without exceeding the manufacturer's design flow rate of the filter element or heater and without by-passing the filter element.

A *public spa* equipped with hydro-massage jet fittings is to be provided with a timing device

- that controls the period of operation of the jet pump, and
- that is placed in a location where the user must exit the *public spa* to reset the timer (Sentence 3.12.4.1.(16).

Sentence 3.12.4.1.(17) requires a *public spa* water heater to be equipped with an upper limit cut-off device

- that is independent of the normal *public spa* water temperature thermostat, and
- that limits the maximum water temperature of the *public spa* to 40°C.

A *public spa* is to be equipped with a water circulation system that is capable of both completely and partially draining and refilling the *public spa* water.

LIGHTING AND EMERGENCY PROVISIONS

In addition to the requirements of Article 3.12.5.1., *public spas* are to comply with the requirements of Sentences 3.11.10.1.(1) to (6). (of 3.11.10. Emergency Provisions for All Public Pools)

An emergency telephone directly connected to an emergency service or to the local telephone utility is to be installed within 30 m of the *public spa*.

All pumps used in a *public spa* are to be capable of being deactivated by an emergency stop button that is clearly labelled and located within the immediate vicinity of the *public spa*.

The emergency stop button

- is to be a switch separate from the *public spa's* timing device,
- is to activate an audible and a visual signal when used, and
- is to have an emergency sign conforming to Sentence 3.11.10.1.(14). (of 3.11.10. Emergency Provisions for All Public Pools)

If a *public spa* and *public pool* are located in the same room or space, the emergency stop buttons required are to deactivate all pumps serving the *public spa* and *public pool*.

SERVICE ROOMS AND STORAGE FOR ALL PUBLIC SPAS

Service rooms and storage facilities for all *public spas* are to comply with the requirements of Article 3.11.11.1. (of 3.11.11. Service Rooms and Storage for all Public Pools).

EXAMPLE QUESTION

- What does "reference equivalency" mean regarding public spas?

  a) site-assembled units are equal to factory built

  b) the water volume after a material alteration is equivalent to before the material alteration

  c) when turnover rates are equal for pools and spas

  d) references to public pool and recirculation system are equal to public spa and water circulation system

OBC Reference ______________________________

EXERCISE #14-3

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1) A public spa is 2m by 3m by 1m deep, what is its required turnover rate?

   a) 15 minutes

   b) 27 minutes

   c) 20 minutes

   d) 30 minutes

OBC Reference ______________________________

2) A public spa uses plastic piping in its water circulation system. Which one of the following water velocities are allowed in the pipe back to the suction side of the pump?

a) 3.0 m/s

b) 1.8 m/s

c) 0.45 m/s

d) 7.0 m/^{2}

OBC Reference ______________________________

3) A public spa is limited to a maximum water temperature. What is that temperature and how is it limited?

a) 40°C by normal operation thermostat

b) 140°F by cut-off device

c) 104°F by thermostat

d) 40°C by cut-off device

OBC Reference ______________________________

STOP

Ontario

Ministry of Municipal Affairs and Housing

BUILDING SERVICES

PARTICIPANT'S MODULE #15

Rapid Transit and Air Supported Structures

JAN06

INTRODUCTION

In this module the safety aspects of specific areas and spaces of public access are examined. Fire alarm systems, annunciators, communication systems, emergency power, standpipe and hose systems and emergency ventilation for rapid transit structures are examined. The requirements of emergency air supply systems for air supported structures are also reviewed.

OBJECTIVES

Upon completion of this module participants will be able to:

- Understand the requirements of Building Systems for a Rapid Transit Station;
- Understand the requirements of Building Systems for an Air Supported Structure.

STOP

RAPID TRANSIT STATIONS -FIRE SAFETY PROVISIONS

Fire Alarm System

As per Article 3.13.5.1., a fire alarm system conforming to Subsection 3.2.4. shall be installed in a *rapid transit station*, except;

Exceptions

Manual pull stations need not be installed in a *rapid transit station*.

Audible signal appliances need not be installed in a *rapid transit station*.

FIRE DETECTORS

Article 3.12.5.3. states that *fire detectors* shall be installed in every *service room*, *ancillary space*, leased space, booth and kiosk, except where the area is *sprinklered*.

CENTRAL SUPERVISING STATION

Each *rapid transit station* shall be monitored by a *central supervising station* as per Article 3.12.5.4.conforming to CAN/ULC-S561, "Installation and Services for Fire Signal Receiving Centres and Systems".

ANNUNCIATORS

Article 3.12.5.5. requires that an annunciator be installed

- in a location that is readily accessible to firefighters entering the *building*, and
- in the *rapid transit station*
    - in a designated collector's booth, or
    - within viewing distance of a designated collector's booth.

ANNUNCIATOR INDICATION

All fire alarm, *fire detectors*, valve switches and water flow indicator signals when activated in a *rapid transit station* shall be indicated on the annunciator at the station as per Article 3.12.5.6.

The annunciator at a *rapid transit station* shall be monitored simultaneously at the *central supervising station*.

As required by Article 3.13.5.6., where a *means of egress* from a *rapid transit station* leads through an adjoining *building*, any *alarm signal* originating in the *building* within two *storeys* above a connection to the station shall

- be indicated on the *rapid transit station* annunciator, and
- cause a message to flash a warning on a sign , that the *means of egress* shall not be used as an *exit* from the station.

In accordance with Article 3.12.5.6., a sign required above shall be located

- at the doors from the *rapid transit station* to the adjoining *building*, and
- in the *means of egress* to the adjoining *building*, at the last point where there is a choice of direction to travel to not less than one other *exit*.

COMMUNICATION SYSTEMS

In a *rapid transit station*, a public address system is required be installed as per Article 3.12.5.8. and shall include loudspeakers which

- can be operated from the *central supervising station*,
- can be operated from the *rapid transit station* in which they are located, and
- designed and located so that voice messages can be heard intelligibly throughout the *public area* in a *rapid transit station*.

Article 3.13.5.8. requires a 2-way communication system be installed in each *rapid transit station* with telephones located at

- the collector's booth, and
- at each end of each platform.

The telephones above shall be provided with connections to the *central supervising station*.

EMERGENCY REPORTING DEVICES

It is required by Article 3.13.5.9. that emergency reporting devices be located on passenger platforms and throughout a *rapid transit station* such that the distance of travel from any point in the *public area* to such a device is not more than 90 m.

The emergency reporting devices required above are permitted to be public telephones with an emergency no charge capability and their location shall be plainly indicated by appropriate signs.

EMERGENCY POWER

An emergency power supply conforming to Article 3.2.7.8. shall be provided for the fire alarm system.

SPRINKLER SYSTEMS

As stated in Article 3.12.5.10., sprinkler systems shall conform with the requirements of Articles 3.2.5.13 to 3.2.5.16.

In addition to the requirements of Subsection 3.13.3. the steel truss enclosure of an escalator shall be *sprinklered*.

There shall be identification on a fire department connection for a sprinkler system in a *rapid transit station* to indicate that the connection is part of the station system.

STANDPIPE AND HOSE SYSTEMS

A standpipe and hose system conforming to the requirements of Subsection 3.2.9. shall be installed in a *rapid transit station*, except as otherwise required or permitted by Article 3.13.5.11.

Where a *rapid transit station* includes more than one standpipe riser Article 3.13.5.11. requires that there be a cross-connection pipe having a diameter not less than 100 mm between each standpipe riser so that supplying of water through any fire department connection will furnish water throughout each riser.

There shall be identification on a fire department connection for a standpipe system in a *rapid transit station* to indicate that the connection is part of the station system.

As per Article 3.13.5.11., hose stations shall be located so that every portion of the *rapid transit station* can be reached by a hose stream and is within 3 m of a hose nozzle when the hose is extended.

In addition to the requirements above, hose stations shall be located in each tunnel not more than 20 m from the end of the platform.

The requirement for hose rack and fire hose in Sentence 3.2.9.4.(2) does not apply in a *rapid transit station*.

Each hose station shall have a 38 mm hose connection and a 65 mm hose connection.

All supply piping shall have a diameter not less than 100 mm in accordance with Article 3.13.5.11.

EMERGENCY VENTILATION

APPLICATION

Every *rapid transit station* shall be provided with an emergency ventilation system conforming to NFPA 130, "Fixed Guideway Transit Systems" as stated in Article 3.13.7.1.

EMERGENCY OPERATION OF ELEVATORS

Manual emergency recall operation shall be provided for all elevators as required by Article 3.13.8.4.

Article 3.13.8.4. requires that key-operated switches for emergency recall described above be provided and be located on the outside of each elevator shaft at the level of the *fare-paid area control*.

In-car emergency service switches shall be provided in all elevator cars.

As per Article 3.13.8.4., keys to operate the switches required above shall be located at

- the annunciator required in Clause 3.13.5.5.(1)(a), and
- the collector's booth designated in Clause 3.13.5.5.(1)(b).

AIR-SUPPORTED STRUCTURES

EMERGENCY AIR SUPPLY

As per Article 3.14.2.6., an *air-supported structure* designed for an *assembly occupancy* with an *occupant load* of more than 200 persons shall have either an automatic emergency engine-generator set capable of powering one blower continuously for 4 h, or a supplementary blower powered by an automatic internal combustion engine.

STOP

EXAMPLE QUESTION

- Regarding the fire alarm system for a *rapid transit station*, which one of the following is NOT required by the OBC ?
    a) an annunciator
    b) *central supervising station*
    c) manual pull stations
    d) a main control unit

OBC Reference ______________________________

EXERCISE #15-1

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. Regarding the sprinkler system for a *rapid transit station*, which one of the following is a further requirement beyond 3.12.3. requirements?
    a) pre-action sprinklers required in *central supervising station* control room
    b) escalator enclosure is to be sprinklered
    c) commercial kiosks sprinklered to standard coverage
    d) dry pipe sprinklers required

OBC Reference ______________________________

2. An *air supported structure* has an occupant load of 200 persons and is equipped with an automatic emergency engine-generator set capable of powering one air blower. Which one of the following is the required continuous operation time?
   a) 2 h
   b) 4 h
   c) no required continuous operation time
   d) until all occupants are safely out in an emergency

OBC Reference ______________________________

3. For a *rapid transit station* which one of the following descriptions the minimum requirements for a standpipe hose station?
   a) 38 and 65 mm connections, hose rack and hose
   b) 38 mm connection, hose rack and hose
   c) 65 mm connection, hose rack and hose
   d) 38 and 65 mm connections

OBC Reference ______________________________

STOP

Ontario Ministry of Municipal Affairs and Housing

BUILDING SERVICES

FACILITATOR'S MODULE #16

Heating, Ventilating and Air-Conditioning

JAN06

INTRODUCTION

In this module we examine the foundations of good engineering practice, the wide variety of standards that form the basis of the OBC structure. Particular attention is paid to applicable editions of referenced standards, and the design, arrangement, and basic requirements for HVAC systems in all *buildings*.

OBJECTIVES

Upon completion of this module participants will be able to:

- Comprehend the concept of good engineering practice;
- Explain the application of design indoor temperatures;
- Reference outside design condition tables accurately;
- Recognize general standards for equipment installation;
- Know and understand the requirements for installation of equipment;
- Describe the requirements for ventilation (natural and mechanical) and control of air contaminants in all buildings.

STOP

GOOD ENGINEERING PRACTICE AND DESIGN

As per Article 6.2.1.1., the OBC requires heating, ventilating and *air-conditioning* systems to be designed, constructed and installed to conform to good engineering practice appropriate to the circumstances as described in the ASHRAE Handbooks as follows:

- 2005 Fundamentals,
- 2002 Refrigeration,
- 2003 HVAC Applications,
- 2004 HVAC Systems and Equipment

And in various other publications including:

- ANSI/ASHRAE/IESNA 90.1-2004, "Energy Standard for Buildings Except Low-Rise Residential Buildings",
- CAN/CSA-F280-M90, "Determining the Required Capacity of Residential Space Heating and Cooling Appliances", when used in conjunctions with the outside winter design temperatures, Supplementary Standard, SB-1 of the OBC,
- CAN/CSA-F326-M91, "Residential Mechanical Ventilation Requirements",
- NFPA Fire Codes (2005 Publication),
- HRAI Digest 2005,
- Hydronics Institute Manuals 2005,
- SMACNA Manuals 1995,
- the Industrial Ventilation Manual, 25th Edition 2004, published by the American Conference of Governmental Industrial Hygienists,
- CAN/CSA-Z317.2, "Special Requirements for Heating, Ventilating and Air-Conditioning (HVAC) Systems in Health Care Facilities", and
- Model National Energy Code for Buildings, 1997.

STRUCTURAL MOVEMENT

The design and installation of mechanical systems and equipment is required by Article 6.2.1.3. to accommodate the maximum relative structural movement provided for in the *construction* of the *building*.

DESIGN INDOOR AIR TEMPERATURES

As per Article 6.2.1.2., *buildings* that are intended for use in the winter months on a continuing basis are required to be insulated and to be equipped with heating facilities that are capable of maintaining indoor air temperatures depending on their classification:

Indoor air temperature of 22°C for Group B (Division 2 or 3 *occupancies*) or Group C (*residential occupancies*) *buildings* at the outside design conditions stated in the OBC.

Minimum indoor air temperature of 18°C or commensurate with the use for all other *buildings* at the outside design conditions stated in the OBC.

OUTSIDE DESIGN CONDITIONS

The outside conditions to be used in designing heating, ventilating and *air-conditioning* systems are to be determined by reference to Supplementary Standard, SB-1 as per Article 6.2.1.7..

The outdoor conditions to be used in designing heating, ventilating and *air-conditioning* systems for *buildings* (intended for use in the winter months on a continuing basis) are to be determined by reference to Table 1.2 of SB-1, using 2.5 per cent design temperature criteria.

By entering the table at the location of, or nearest to, the *building* location, design temperatures and other location specific information is determined.

STOP

EXAMPLE QUESTION

- What is the 2.5% January outside design condition temperature for a building located in Alliston Ontario?
  - a) –23°C
  - b) –26°C
  - c) –25°C
  - d) 29°C

Answer: Enter the table horizontally at Alliston and vertically under Design Temperature January 2.5 % °C. Where the horizontal entry intersects with vertical entry . . . retrieve data.

TABLE 16-2

Location	Design Temperature				Degree Days Below 18°C
	January		July 2 ½ %		
	2 ½ %, °C	1 %, °C	Dry, °C	Wet, °C	
Ailsa Craig	-17	-19	30	23	4 000
Ajax	-20	-22	30	23	4 000
Alexandria	-24	-26	30	23	4 600
Alliston	**-23**	**-25**	**29**	**23**	**4 400**
Almonte	-26	-28	30	23	4 850
Column 1	2	3	4	5	6

EXERCISE #16-1

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. What is the value for Degree Days Below 18 °C for Beaverton, Ontario?
    a) 4550
    b) 5400
    c) 950
    d) 4100

OBC Reference ______________________________

2. What is the minimum indoor air temperature required for movie theatres?
    a) 22 °C
    b) 20 °C
    c) 18 °C
    d) To good engineering practice.

OBC Reference ______________________________

3. What outdoor condition design temperature criteria is to be used in designing heating, ventilating and air-conditioning systems for Group B *care occupancies*?
    a) 2.5%
    b) 1%
    c) Part 6 and to good engineering practice.
    d) 22 °C

OBC Reference ______________________________

4. What exact edition of the NFPA Fire Codes is applicable for conformance to the OBC?
    a) 1992
    b) 1996
    c) 2005
    d) Latest Edition

OBC Reference ______________________________

STOP

INSTALLATION STANDARDS – ALL BUILDINGS

EARTH ENERGY SYSTEMS

As per Article 6.2.1.4., the design and installation of earth energy systems are to conform to CAN/CSA-C448.2-M, "Design and Installation of Earth Energy Heat Pump Systems for Residential and Other Small Buildings" when:

- They serve single *dwelling units*, or
- *buildings* where the conditioned space is not greater than 1 400 m^2.

Where the heated floor space area is greater than 1400 m^2 the design and installation of earth energy systems is to conform to CAN/CSA-C448.1-M, "Design and Installation of Earth Energy Heat Pump Systems for Commercial and Institutional Buildings" as per Article 6.2.1.4.

Solid Fuel-Burning Appliances

Article 6.2.1.4. requires that solid fuel-burning *appliances* for central heating systems must conform to CAN/CSA-B366.1-M, "Solid Fuel-Fired Central Heating Appliances". Their installation is required to comply with:

- CAN/CSA-B365-M, "Installation Code for Solid Fuel-Burning Appliances and Equipment" and,
- the manufacturer's installation instructions.

The design and installation of solid fuel-burning *stoves*, *ranges* and *space heaters*, including the requirements for combustion air, are to conform to the requirements of:

- CAN/CSA-B365-M, "Installation Code for Solid Fuel-Burning Appliances and Equipment" and,
- the manufacturer's installation instructions.

FIREPLACES – ALL BUILDINGS

Fireplaces are to conform to the requirements of OBC Section 9.22. Fireplaces as per Article 6.2.1.5.

HEAT RECOVERY VENTILATORS – ALL BUILDINGS

As required by Article 6.2.1.6., heat recovery ventilators with rated capacities of not less than 25 L/s and not more than 200 L/s are to be installed in accordance with Article 9.32.3.11. with the following exception:

Where *electric space heating*, other than forced-air electric heating system, is provided in *buildings* of *residential occupancy* (within the scope of Part 9), the mechanical ventilation system must include heat recovery ventilators designed to provide a heat recovery efficiency the greater of:

- the minimum rated efficiency required by the *Energy Efficiency Act*, or
- a minimum 55% sensible heat recovery efficiency when tested to the low temperature thermal and ventilation performance test method set out in CAN/CSA-C439, "Test for Rating the Performance of Heat Recovery Ventilators", at a Station 1 test temperature of –25°C at an air flow not less than 30 L/s.

Where a heat recovery ventilator is installed to conform to OBC 9.32.3 Mechanical Ventilation (self-contained system serving one *dwelling unit*), it is required to have

- a minimum 55% sensible heat recovery efficiency when tested to the low temperature thermal and ventilation performance test method set out in CAN/CSA-C439, "Test for Rating the Performance of Heat Recovery Ventilators", at a Station 1 test temperature of –25°C at an air flow not less than 30 L/s.

Heat recovery ventilators with rated capacities equal to or greater than 200 L/s are to be installed in accordance with good engineering practice.

STOP

EXAMPLE QUESTION

- Which of the following earth energy systems must conform to CAN/CSA-C448.2, "Design and Installation of Earth Energy Heat Pump Systems for Residential and Other Small Buildings"?
  - a) Condominium, 20 self contained *dwelling units*
  - b) Single family residence.
  - c) High School, 1 600 m^2 heated floor area.
  - d) Strip mall, 15 tenants, 100 m^2 heated floor area each.

OBC Reference ______________________________

EXERCISE #16-2

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. The installation of solid fuel-burning appliances for central heating systems is specifically required to comply with CAN/CSA-B365-M and which one of the following?
   - a) Good engineering practice.
   - b) Part 9 OBC.
   - c) The manufacturer's installation instructions.
   - d) CAN/CSA-C448.2

OBC Reference ______________________________

2. Fireplaces are to conform to?
   - a) CAN/CSA-C445-M if output is under 35 kW
   - b) OBC Section 9.22
   - c) OBC Part 11
   - d) Minimum 55% sensible heat recovery efficiency.

OBC Reference ______________________________

3. In which of the following *buildings* may a 50 L/s heat recovery ventilator be subject to the minimum rated efficiency required by the *Energy Efficiency Act*?
    a) Two storey apartment, six *dwelling units*, electric baseboard heating, central washroom exhaust.
    b) Single-family home, forced-air electric heat.
    c) Dentist office, under 600 m^2 area, baseboard electric heat.
    d) Single family home, forced air gas heat.

OBC Reference ______________________________

4. To which of the following requirements would a 1000 m^2 residence equipped with a ground source heat pump conform?
    a) CAN/CSA-B365-M
    b) CAN/CSA-C448.2
    c) Good engineering practice
    d) CAN/CSA-C448.1

OBC Reference ______________________________

STOP

INSTALLATION – ALL BUILDINGS

GENERAL REQUIREMENTS

Article 6.2.1.8. states that equipment requiring periodic maintenance and forming part of is heating, ventilating or *air-conditioning* system is to be installed with provision for access for inspection, maintenance, repair and cleaning.

Mechanical equipment must be protected with *guards* to prevent injury to the public or maintenance staff.

Equipment forming part of a heating, ventilating or *air-conditioning* system that may be adversely affected by freezing temperatures and that is located in an unheated area is to be protected from freezing.

EXPANSION, CONTRACTION AND SYSTEM PRESSURE

Heating and cooling systems are to be designed to allow for expansion and contraction of heat transfer fluid and to maintain system pressure within the rated working pressure limits of all components of the system as per Article 6.2.1.9.

ASBESTOS

As required by Article 6.2.1.10., asbestos must not be used in air distribution systems or equipment in a form or in a location where asbestos fibres could enter the air supply or return systems.

ACCESS OPENINGS

Any covering of an access opening through which a person could enter must be openable from the inside without the use of keys where there is a possibility of the opening being accidentally closed while the system or equipment is being serviced as per Article 6.2.1.11.

COMBUSTIBLE TUBING

Article 6.2.1.12. permits *combustible* tubing for pneumatic controls may be used in *buildings* required to be of *noncombustible construction* providing it has an outside diameter not exceeding 10 mm.

EXAMPLE QUESTION

- A common way to allow for expansion and contraction in heating and cooling systems is by which of the following methods?
  - a) Manual control valve
  - b) Safety relief valve
  - c) Expansion tank
  - d) Guard to prevent injury

OBC Reference ____________________

EXERCISE #16-3

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. What characteristic of asbestos prevents its use in locations where it could enter the air supply or return system?
   a) Combustibility
   b) Air transportable fibres
   c) Brittleness
   d) Low strength

OBC Reference ______________________________

2. Heating, ventilating or *air-conditioning* equipment requiring periodic maintenance is to be provided with which one of the following?
   a) Internal lighting
   b) Lockable doors
   c) Access
   d) Easily cleaned components

OBC Reference ______________________________

3. Which of the following diameters of *noncombustible* tubing for pneumatic controls may be used in buildings required to be of *noncombustible construction*?
   a) 10 mm
   b) 51 mm
   c) 11 mm
   d) all diameters

OBC Reference ______________________________

STOP

REQUIRED VENTILATION – ALL BUILDINGS

Generally, all rooms and spaces in *buildings* are to be ventilated. The rates at which outdoor air is supplied to rooms and spaces in *buildings* by ventilation systems are to be not less than the rates required by ANSI/ASHRAE Standard 62, "Ventilation for Acceptable Indoor Air Quality" in accordance with Article 6.2.2.1.

Exceptions

Sentence 6.2.2.1.(1) states that self -contained mechanical ventilation systems, serving only one *dwelling unit*, are to be considered to satisfy the OBC for required ventilation if they conform to the requirements of OBC 9.32.3. Mechanical Ventilation.

Storage garages and *repair garages* are required to conform to Article 6.2.2.3.

NATURAL VENTILATION – ALL BUILDINGS

As required by Article 6.2.2.2., when rooms and spaces in *buildings* are to be ventilated, the required ventilation must be provided by mechanical ventilation, except that it can be provided by natural ventilation or a combination of natural and mechanical ventilation in:

- *buildings* of other than *residential occupancy* having an *occupant load* of not more than one person per 40 m^2 during normal use,
- *buildings* of *industrial occupancy* where the nature of the process contained therein permits or requires the use of large openings in the *building* envelope even during the winter, or
- seasonal *buildings* not intended to be occupied during the winter.

In addition, where climatic conditions permit, *buildings* of other than *residential occupancy* may be ventilated by natural methods where engineering data demonstrates that such a method will provide the required ventilation for that *occupancy*.

There are specific requirements for the natural ventilation of rooms and spaces in *residential occupancies* as described in OBC 9.32.2. Natural Ventilation.

AIR CONTAMINANTS – ALL BUILDINGS

Air contaminants released within *buildings* are to be removed as much as possible at their points of origin and must not be permitted to accumulate in concentrations greater than permitted in the Industrial Ventilation Manual published by the American Conference of Governmental Industrial Hygienists as per Article 6.2.2.4.

Article 6.2.2.4. requires systems serving spaces that contain sources of contamination and systems serving other occupied parts of the *building* but located in or running through spaces that contain sources of contamination must be designed in such a manner as to prevent spreading of contamination to other occupied parts of the *building*.

Heating, ventilating and *air-conditioning* systems must be designed to minimize growth of micro-organisms according to good engineering practice described in the OBC.

Mechanical rooms containing refrigeration equipment are required to ventilated in accordance with CSA B52, "Mechanical Refrigeration Code" as per Article 6.2.2.4.

CRAWL SPACES AND ATTIC OR ROOF SPACES – ALL BUILDINGS

As per Article 6.2.2.7., every crawl space and every *attic or roof space* requires ventilation by natural or mechanical means.

Buildings classified under OBC Part 9 may meet this requirement by conformance to OBC 9.18. Crawl Spaces and OBC 9.19. Roof Spaces.

STOP

EXAMPLE QUESTION

- Under which design condition may rooms and spaces in *buildings* be ventilated in accordance to requirements other than OBC Part 6?
    - a) Self-contained mechanical ventilation systems, serving only one *suite* in a *business occupancy*.
    - b) Any building occupying an area less than 10 square meters.
    - c) Self-contained mechanical ventilation systems, serving only one *dwelling unit*.
    - d) Self-contained mechanical ventilation systems, serving only one *live/work unit*.

OBC Reference ______________________________

EXERCISE #16-4

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. Which of the following rooms and spaces are NOT required to conform to the outdoor air rates published by ANSI/ASHRAE Standard 62?
    - a) Apartments with central washroom exhaust
    - b) Department store less than 600 m^2 area.
    - c) A self-contained hotel *suite*.
    - d) Vehicle *repair garage* greater than 600 m^2 area.

OBC Reference ______________________________

2. Which of the following buildings can be ventilated by natural ventilation alone?
    - a) A house of 160 m^2 area, *occupant load* of 4 persons.
    - b) A warehouse of 1600 m^2 area *occupant load* of 4 persons.
    - c) An artist's studio containing large openable windows in the building envelope.
    - d) A self-contained *dwelling unit*.

OBC Reference ______________________________

3. Which of the following rooms and spaces are NOT required to conform to the limits of concentrations of air contaminants in the Industrial Ventilation Manual?
    - a) Self-contained *dwelling units*.
    - *b)* *Industrial occupancies* where the nature of the process permits or requires the use of large openings in the *building envelope*.
    - c) Seasonal *buildings* not intended to be occupied during the winter
    - d) All rooms and spaces in *buildings* must conform.

OBC Reference ______________________________

4. Mechanical rooms containing refrigeration equipment are to be ventilated by which of the following?
    - a) Large openings in the building envelope.
    - b) Systems serving other parts of the building.
    - c) Conformance to CSA B52.
    - d) Good engineering practice.

OBC Reference ______________________________

STOP

VENTILATION OF STORAGE AND REPAIR GARAGES

In accordance with Article 6.2.2.3., an enclosed *storage garage* is to have a mechanical ventilation system designed to

- limit the concentration of carbon monoxide to not more than 100 parts per million of air when measured between 900 mm and 1200 mm from the floor, where the majority of the vehicles are gasoline fuelled
- limit the concentration of nitrogen dioxide to not more than 3 parts per million of air when installed in accordance with manufacturer's instructions, where the majority of the vehicles stored are powered by diesel fuelled engines, or
- provide, during operating hours, a continuous supply of outdoor air at a rate of not less than 3.9 L/s for each square metre of floor area.

Mechanical ventilation systems provided to limit the concentration of carbon monoxide are required by Article 6.2.2.3. to be controlled automatically by carbon monoxide monitoring devices, located so as to provide full protection throughout the *storage garage*.

Mechanical ventilation systems are to be designed such that the pressure in the *storage garage* is less than the pressure in adjoining *buildings* of other *occupancy*, or in adjacent portions of the same *building* having a different *occupancy* as per Article 6.2.2.3.

Exceptions

In *storage garages* where motor vehicles are parked by mechanical means, ventilation requirements may be reduced by one half as per Sentence 6.2.2.3.(4).

Sentence 6.2.2.3.(5) states that ticket and attendant booths of *storage garages* shall be pressurized with a supply of outdoor air.

The requirements above do not apply to *open-air storeys* in a *storage garage* as per Sentence 6.2.2.3.(6).

Repair Garage

A *repair garage* is to have a mechanical ventilation system designed to limit the exposure of workers to carbon monoxide. In a *repair garage*, when a repair bay is not immediately adjacent to an outside garage door opening, a system capable of providing continuous general ventilation of not less than 700 L/s per internal bay shall be provided to operate continuously, or

- be controlled automatically by carbon monoxide monitoring devices, located so as to provide full protection throughout the *repair garage*.

The general ventilation system described above is not required when tail pipes of vehicles are directly connected to local mechanical exhaust systems that terminate outdoors.

HAZARDOUS GASES, DUSTS OR LIQUIDS

Article 6.2.2.5. requires systems serving spaces that contain hazardous gases, dusts or liquids are to be designed, constructed and installed in conformance with the provisions of the Ontario Fire Code made under the *Fire Marshals Act*, or in the absence of requirements pertinent to such systems,

- to good engineering practice such as is described in the publications of the National Fire Protection Association and
- in the National Fire Code of Canada 2005.

COMMERCIAL COOKING EQUIPMENT

All commercial cooking equipment is to be provided with ventilation systems designed, constructed and installed to conform to NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations", except as required by Sentence 3.6.3.1.(1) (*vertical*) and Article 3.6.4.2. (*horizontal services spaces* penetrating *fire separations*) as per Article 6.2.2.6.

NFPA 96 takes into consideration the high temperature cooking fuels in common use and prescribes appropriate fire suppression for the hazard.

STOP

EXAMPLE QUESTION

- A enclosed *storage garage* is 3 *storeys* of 1000 m^2 per storey, with no carbon monoxide monitoring system. Parking is permitted on the roof of the garage. Which one of the following represents the required continuous supply of outdoor air, based on the *floor area*?
  - a) 15,600 L/s
  - b) 11,700 L/s
  - c) 7800 L/s
  - d) 3.9 L/s

OBC Reference ______________________________

EXERCISE #16-5

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. An enclosed *storage garage* is to have a mechanical ventilation system designed to limit the concentration of carbon monoxide to not more than?
   - a) 900 parts per million of air
   - b) 1200 parts per million of air
   - c) 100 parts per million of air
   - d) 3.9 parts per million of air

OBC Reference ______________________________

2. Which one of the following is the first required reference source for the design, and construction of systems serving spaces that contain hazardous gases, dusts or liquids?
    a) National Fire Protection Association
    b) The *Fire Marshals Act*
    c) National Fire Code of Canada 2005
    d) Ontario Fire Code

OBC Reference ______________________________

3. All commercial cooking equipment is to be provided with ventilation systems designed, constructed and installed to conform to?
    a) Ontario Fire Code under The *Fire Marshals Act*
    b) NFPA 96
    c) OBC Article 3.6.4.2
    d) National Fire Code of Canada 2005

OBC Reference ______________________________

4. A *repair garage* has three repair bays immediately adjacent to an outside garage door opening. There is no local mechanical exhaust system to allow attachment of tail pipes of vehicles, directly connected. Tail pipes are fitted with extensions from the exhaust pipe to the overhead doors and terminate outdoors. Which one of the following represents the capacity of the required general ventilation system in L/s?
    a) 700 L/s
    b) 2 100 L/s
    c) 0 L/s
    d) 3.9 L/s

OBC Reference ______________________________

STOP

AIR DUCT SYSTEMS

Application

As per Article 6.2.3.1., the design, construction and installation of air duct distribution systems serving heating, ventilating and *air-conditioning* systems is to conform to Subsection 6.2.3 Air Duct Systems.

Subsection 6.2.4. Air Ducts for Low Capacity Systems applies to individual *dwelling units* for the design, construction and installation of air duct distribution systems which serve heating, ventilating and *air-conditioning* systems within the scope of Part 9.

MATERIALS IN AIR DUCT SYSTEMS

All ducts, duct connectors, associated fittings and *plenums* used in air duct systems are to be constructed of steel, aluminum alloy, copper, clay, asbestos-cement or similar *noncombustible* material as per Article 6.2.3.2.

Exceptions

Sentence 6.2.3.2.(1) permits ducts, associated fittings and *plenums* are permitted to contain *combustible* material provided they

- conform to the appropriate requirements for Class 1 duct materials in CAN/ULC-S110-M, "Test for Air Ducts",
- conform to Article 3.1.5.15. Combustible Ducts, in a *building* required to be of *noncombustible construction*,
- conform to Subsection 3.1.9. Building Services in Fire Separations and Fire Rated Assemblies,
- are used only in horizontal runs in a *building* required to be of *noncombustible construction*,
- are not used in vertical runs serving more than 2 *storeys* in a *building* required to be of *noncombustible construction*, and
- are not used in air duct systems in which the air temperature may exceed 120°C.

Duct sealants are to have a *flame-spread rating* of not more than 25 and a smoke developed classification of not more than 50 as per Sentence 6.2.3.2.(3).

Duct connectors that contain *combustible* materials and that are used between ducts and air outlet units are required by Article 6.2.3.2. to conform to the appropriate requirements for Class 1 air duct materials in CAN/ULC-S110-M, "Test for Air Ducts",

- be limited to 4 m in length,
- be used only in horizontal runs, and
- not penetrate required *fire separations*.

Excessive Moisture

The above allowable materials when used in a location where they may be subjected to excessive moisture must have no appreciable loss of strength when wet and are to be corrosion-resistant.

CONNECTIONS AND OPENINGS IN AIR DUCT SYSTEMS

Air duct systems are required by Article 6.2.3.3. to have

- tight-fitting connections throughout, and
- no openings other than those required for proper operation, inspection and maintenance of the system.

Article 6.2.3.3. requires access openings to be provided in duct systems where lint, grease, debris, paper or other combustible material may accumulate in *plenums* and ducts.

COVERINGS, LININGS, ADHESIVES AND INSULATION

Article 6.2.3.4. requires coverings, linings and associated adhesives and insulation of air ducts, *plenums* and other parts of air duct systems are to be of *noncombustible* material when exposed to heated air or radiation from heat sources that would result in the exposed surface exceeding a temperature of 120°C.

When *combustible* coverings and linings, including associated adhesives and insulation, are used, they are required by Article 6.2.3.4. to have

- a *flame-spread rating* of not more than 25 on any exposed surface or any surface that would be exposed by cutting through the material in any direction, and
- a smoke developed classification of not more than 50,

However, the outer covering of ducts, *plenums* and other parts of air duct systems used within an assembly of *combustible construction* may have an exposed surface *flame-spread rating* of not more than 75 and may have a smoke developed classification greater than 5050 as per Sentence 6.2.3.4.(2).

Combustible coverings and linings must not flame, glow, smoulder or smoke when tested in accordance with the method of test in ASTM C411, "Hot-Surface Performance of High-Temperature Thermal Insulation" at the maximum temperature to which the coverings and linings are to be exposed in service as per Article 6.2.3.4.

Foamed plastic insulation must not be used as part of an air duct or for insulating an air duct as per Sentence 6.2.3.4.(5).However, foamed plastic insulation may be used in a ceiling space that acts as a return air *plenum* provided the foamed plastic insulation is protected from exposure to the *plenum* in accordance with Article 3.1.5.12. Combustible Insulation and its Protection

Combustible coverings and linings of ducts, including associated adhesives and insulation, are required by Article 6.2.3.4. to be interrupted at the immediate area of operation of heat sources in a duct system, such as electric resistance heaters or fuel-burning heaters or *furnaces*, and where the duct penetrates a *fire separation*.

Linings of ducts are to be installed so that they will not interfere with the operation of volume or balancing dampers, *fire dampers*, *fire stop flaps* and other *closures* as per Article 6.2.3.4.

UNDERGROUND DUCTS

As required by Article 6.2.3.5., underground ducts shall be constructed to provide interior drainage from and access to all low points, not be connected directly to a sewer, and be installed and constructed of materials in conformance with ASHRAE Handbooks, SMACNA Manuals and the HRAI Digest.

A clean-out or pump-out connection is required to be provided in an underground duct system at every low point of the duct system.

CLEARANCES FROM COMBUSTIBLES

The clearances from *combustible* material and supply *plenums*, *supply ducts*, boots and register boxes of heating systems are to conform to requirements of 6.2.4. Low Capacity Systems as per Article 6.2.3.19.

FIRE DAMPERS

Fire dampers are required by Article 6.2.3.6. to conform to the requirements of Subsection 3.1.8. Fire Separations and Closures.

SMOKE DETECTOR CONTROL

As per Article 6.2.3.7., air handling systems are to incorporate *smoke detector* control where required by Article 3.2.4.12. Prevention of Smoke Circulation.

EXHAUST DUCTS AND OUTLETS

Exhaust ducts of nonmechanical ventilating systems serving separate rooms or spaces must not be combined as per Article 6.2.3.8.

Exhaust ducts of nonmechanical ventilating systems serving similar *occupancies* may be combined immediately below the point of final delivery to the outside, such as at the base of a roof ventilator as stated in Article 6.2.3.8.

Exhaust ducts of ventilating systems are required by Article 6.2.3.8. to have provision for the removal of condensation where this may be a problem.

Exhaust outlets are to be designed to prevent back draft under wind conditions.

Article 6.2.3.8. requires exhaust systems shall discharge directly to the outdoors. However, exhaust systems are permitted to exhaust into a *storage garage* provided

- such systems serve rooms which are accessible only from the *storage garage*,
- the exhaust contains no contaminants that would adversely affect the air quality in the storage garage, and
- they are designed in accordance with Sentence 6.2.3.9.(3).

Exhaust ducts connected to laundry drying equipment are to be independent of other *exhaust ducts*, designed and constructed so that the entire duct can be cleaned, and constructed of smooth corrosion-resistant material.

Exhaust Interconnection

Exhaust ducts serving rooms containing water closets, urinals, basins, showers or slop sinks are required by Article 6.2.3.8. to be independent of other *exhaust ducts*.

Exhaust ducts serving rooms containing residential cooking equipment are to be independent of other *exhaust ducts*.

Exceptions

As per Sentence 6.2.3.8.(10), two or more exhaust systems described above may be interconnected or connected with *exhaust ducts* serving other areas of the *building* provided

- the connections are made at the inlet of an exhaust fan, and all interconnected systems are equipped with suitable back pressure devices to prevent passage of odours from one system to another when the fan is not in operation, or

- the exhaust ducts discharge to a shaft that is served by an exhaust fan having a capacity that is equal to or greater than the combined capacity of the exhaust fans discharging to the plenum multiplied by the operation diversity factor, provided that the exhaust fan serving the shaft operates continuously.

Passing Through Unheated Space

Where *exhaust ducts* containing air from heated spaces pass through or are adjacent to unheated spaces, the ducts are required by Sentence 6.2.3.8.(11) to be insulated to prevent moisture condensation in the ducts.

Exhaust Air Quantities

Rooms containing water closets, urinals, showers or slop sinks are to be mechanically ventilated and shall be capable of exhausting air at the rate of not less than 24 L/s for each sanitary fixture listed as per Sentence 6.2.3.8.(14).

STOP

EXAMPLE QUESTION

- In duct systems where lint, grease, debris, paper or other combustible material may accumulate in *plenums* and ducts, which one of the following provisions is required?

  a) tight fitting connections
  b) access openings
  c) openings only in horizontal runs
  d) no openings

OBC Reference ____________________

EXERCISE #16-6

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. Exhaust systems are permitted to exhaust into a *storage garage* provided certain requirements are met. Which one of the following forms part of the conditions?

    a) serve rooms accessible only from the garage
    b) must not be connected directly to a sewer
    c) provided with fire dampers
    d) shall incorporate *smoke detector* control

OBC Reference ______________________________

2. Required exhaust for a room is calculated on the basis of 24 L/s for each sanitary fixture. Which one of the following is the exception to the requirement?

    a) a water closet;
    b) a lavatory;
    c) a shower;
    d) a slop sink.

OBC Reference ______________________________

3. *Combustible* coverings and linings of ducts, including associated adhesives and insulation, are required to be interrupted under certain arrangements. Which one of the following arrangements does NOT require an interruption of the *combustible* material?
    a) near a fuel-burning heater;
    b) near a cooling coil;
    c) near a electric resistance heater;
    d) near a furnace.

OBC Reference ______________________________

STOP

INTERCONNECTION OF SYSTEMS

Air duct systems serving *storage garages* must not be interconnected with other parts of the *building*, except as permitted by Sentence 6.2.3.8.(6) as per Article 6.2.3.9..

In a *residential occupancy*, air from one *suite* must not be circulated to any other *suite* nor to a *public corridor* or public stairway.

Corridors

Article 6.2.3.9. requires that a *public corridor* (corridor that provides *access to exit* from more than one suite) that is required to be fire separated from the remainder of the floor area or a corridor serving the public, must not be used as a portion of a supply, return or exhaust air system serving adjoining areas. However, use may be as part of a supply air system serving toilet rooms, bathrooms, shower rooms and similar auxiliary spaces opening directly to the *public corridor* or corridor used by the public.

As previously noted, exhaust ducts are permitted to discharge into a *storage garage* per Sentence 6.2.3.8.(6). The conditions for discharge into a *storage garage* also include requirements per Sentence 6.2.3.9.(3) which require the following:

- *storage garage* exhaust system must operate continuously;
- the capacity of *storage garage exhaust system* is required to be equal to or exceed the volume of the exhaust entering the garage, and
- a leakage rate 1 smoke/fire damper is required to be provided near the duct outlet location in the *storage garage* to prevent air from the storage garage from entering the exhaust ductwork system in the event the *building*'s exhaust system shuts down.

A *public corridor* may be used as part of an engineered smoke control system as permitted by Sentence 6.2.3.9.(5). Infiltration due to corridor pressurization is permitted into a *residential occupancy* from a *public corridor* by Sentence

6.2.3.9.(6).

DUCTS IN EXIT STAIRWAYS

As per Article 6.2.3.10., duct penetration of *fire separations* separating *exits* from the remainder of the *building* are to be in accordance with Article 3.4.4.4. Integrity of Exits.

MAKE-UP AIR

In ventilating systems that exhaust air to the outdoors, it is required by Article 6.2.3.11. that provision is to be made for the admission of a supply of make-up air in sufficient quantity so that the operation of the exhaust system and other exhaust equipment or combustion equipment is not adversely affected. In addition, make-up air facilities are required to be interlocked with the exhaust devices. Make-up air that is intended to be introduced directly from the outdoors to portions of a building that are occupied during winter months is required to be tempered so as to maintain indoor design temperatures.

SUPPLY, RETURN, INTAKE AND EXHAUST AIR OPENINGS

As required by Article 6.2.3.12., supply, return and exhaust air openings in rooms or spaces in *buildings* when located less than 2 m above the floor shall be protected by grilles having openings of a size that will not allow the passage of a 15 mm diameter sphere.

Combustible grilles, diffusers and other devices for supply, return and exhaust air openings in rooms are required by Article 6.2.3.12. to conform to the *flame-spread rating* and smoke developed classification requirements for the interior finish of the surface on which they are installed.

Outdoor air intakes and exhaust outlets at the *building* exterior are to be designed or located so that the air entering the *building* system will not contain more contaminants than the normal exterior air of the locality in which the *building* is situated as per Article 6.2.3.12.

Article 6.2.3.12. requires exterior openings for outdoor air intakes and exhaust outlets to be shielded from the entry of snow and rain and to be fitted with corrosion-resistant screens of mesh having openings not larger than 15 mm.

However, where experience has shown that climatic conditions require larger openings to avoid icing over of the screen openings, larger openings are to be provided.

Required screens are to be accessible for maintenance.

FILTERS

Air filters for air duct systems are required by Article 6.2.3.13. to conform to the requirements for Class 2 air filter units as described in CAN4-S111, "Fire Tests For Air Filter Units".

When electrostatic-type filters are used, they are to be installed so as to ensure that the electric circuit is automatically de-energized when filter access doors are opened and in *dwelling units* when the system circulating fan is not operating.

Odour Removal Equipment

When odour removal equipment of the adsorption type is used it is to be installed to provide access so that adsorption material can be reactivated or renewed, and protected from dust accumulation by air filters installed on the inlet side as per Article 6.2.3.13.

Facilities for flushing and drainage are to be provided where filters are designed to be washed in place.

AIR WASHERS AND EVAPORATIVE COOLING SECTIONS OR TOWERS

As required by Article 6.2.3.14., the filter and water evaporation medium of every air washer and evaporative cooling section enclosed within a *building* is to be made of *noncombustible* material.

Sumps for air washer and evaporative cooling sections are to be constructed and installed so that they can be flushed and drained.

Evaporative cooling sections or towers are to comply with the requirements of NFPA 214, "Water-Cooling Towers".

FANS AND ASSOCIATED AIR HANDLING EQUIPMENT

Article 6.2.3.15. requires fans for heating, ventilating and *air-conditioning* systems are to be located and installed so that their operation

- does not adversely affect the draft required for proper operation of fuel-fired *appliances*, and
- does not allow the air in the air duct system to be contaminated by air or gases from the *boiler*-room or *furnace*-room.

Fans and associated air handling equipment, such as air washers, filters and heating and cooling units, when installed on the roof or elsewhere outside the *building*, are to be of a type designed for outdoor use.

CONSTRUCTION AND INSTALLATION OF DUCTS AND PLENUMS

Rectangular panels in *plenums* and ducts more than 300 mm wide are to be shaped to provide sufficient stiffness as per Article 6.2.3.18.

Rectangular duct connections are to be made with S and drive cleats or equivalent mechanical connections.

All round duct joints are to be tight-fitting and lapped not less than 25 mm.

Support

Article 6.2.3.18. requires ducts to be securely supported by metal hangers, straps, lugs or brackets, except that where zero clearance is permitted, wooden brackets may be used.

Trunk *supply ducts* are to not be nailed directly to wood members.

Branch ducts are to be supported at suitable spacing to maintain alignment and prevent sagging as per Article 6.2.3.18.

Fire Stopping and Combustible Material

Where the installation of heating *supply ducts* in walls and floors creates a space between the duct and construction material, the space is required by Article 6.2.3.18. to fire stopped with *noncombustible* material at each end.

Moisture and Thermal Protection

As required by Article 6.2.3.18., ducts in or beneath concrete slabs-on-ground are to be watertight, corrosion-, decay- and mildew-resistant.

Where a *supply* or *return duct* is not protected by an insulated exterior wall, or the duct is exposed to an unheated space, it is to be insulated to prevent condensation.

CONNECTORS

Vibration isolation connectors in air duct systems are required by Article 6.2.3.16. to be *noncombustible*, except that *combustible* fabric connectors are permitted provided they

- do not exceed 250 mm in length,
- comply with the flame-resistance requirements of CAN/ULC-S109, "Flame Tests of Flame-Resistant Fabrics and Films", and
- are not used in a location where they are exposed to heated air or radiation from heat sources that may cause the exposed surface to exceed a temperature of 120°C.

TAPE

Tape used for sealing joints in air ducts, *plenums* and other parts of air duct systems is to meet the flame-resistance requirements for fabric in CAN/ULC-S109, "Flame Tests of Flame-Resistant Fabrics and Films" as per Article 6.2.3.17.

RETURN-AIR SYSTEM

The return-air system is to be designed to handle the entire air supply as per Article 6.2.3.20.

Where any part of a *return duct* will be exposed to radiation from the *furnace* heat exchanger or other radiating part within the *furnace*, a *return duct* directly above or within 600 mm of the outside *furnace* casing is required by Article 6.2.3.20. to be *noncombustible*.

Return ducts serving solid fuel-fired *furnaces* are to be constructed of *noncombustible* material.

Where *combustible return ducts* are permitted, they are to be lined with *noncombustible* material below floor registers, at the bottom of vertical ducts and under *furnaces* having a bottom return.

As per Article 6.2.3.20., the return-air system is to be designed so that the negative pressure from the circulating fan cannot affect the *furnace* combustion air supply nor draw combustion products from joints or openings in the *furnace* or *flue pipe*.

Return-air inlets must not be installed in an enclosed room or crawl space that provides combustion air to a fuel-fired *appliance*.

STOP

EXAMPLE QUESTION

- Where an insulated exterior wall does not protect a supply or return duct, it is to be insulated. Which one of the following is the primary reason for the duct insulation?
    a) to prevent condensation;
    b) to conserve energy
    c) to better control room temperature
    d) to provide a vapour barrier

OBC Reference ______________________________

EXERCISE #16-7

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. In a *residential occupancy,* air from a bedroom of a *suite* may be circulated to which one of the following areas?
    a) a *public corridor;*
    b) the bedroom of an adjacent *suite;*
    c) a public stairway;
    d) the kitchen of the same *suite.*

OBC Reference ______________________________

2. *Return ducts* serving solid fuel-fired *furnaces* are required to be constructed of?
    a) lined *combustible* material;
    b) steel trunk *supply ducts* nailed directly to wood;
    c) *flue pipe* material;
    d) *noncombustible* material.

OBC Reference ______________________________

3. An exhaust fan is installed on a *building* roof, which one of the following is a requirement or permitted arrangement for the installation?
    a) 12 m clearance from sources of ignition such as *chimneys*
    b) fan to be of a type designed for outdoor use;
    c) fitted with corrosion-resistant screen of mesh opening 25 mm square;
    d) drain connection direct to sanitary sewer

OBC Reference ______________________________

4. A pressure-treated wooden cooling tower containing an evaporative cooling section of *combustible* material is located on a *building*. Which one of the following clearances conforms to the OBC regarding distance to a chimney?
    - a) 30 m
    - b) 12 m
    - c) compliance to NFPA 214
    - d) 1200 mm

OBC Reference ______________________________

STOP

AIR DUCTS FOR LOW CAPACITY SYSTEMS

APPLICATION

Heating, ventilating and *air-conditioning* systems serving individual *dwelling units* in the scope of Part 9, are considered low capacity systems.

As per Article 6.2.4.1., the scope of this module is the design, construction and installation of air duct distribution systems that serve these low capacity systems.

Materials in Air Duct Systems

This topic has already been covered under the general Subsection 6.2.3. Air Duct Systems, earlier in this module.

Allowable Exceptions

This topic has already been covered under the general Subsection 6.2.3. Air Duct Systems, earlier in this module.

As will be seen under the Return-Air System topic, *return ducts* are to be constructed of material having a surface *flame-spread rating* of not more than 150. This allows the *designer* of house type systems the flexibility of utilizing stud and joist spaces for return air ducting as an economical alternative to *noncombustible* material.

Excessive Moisture

Allowable materials when used in a location where they may be subjected to excessive moisture must have no appreciable loss of strength when wet and are to be corrosion-resistant.

DUCT DESIGN

Galvanized steel or aluminum *supply ducts* are required to conform to Table 6.2.4.2.

Article 6.2.4.2. requires the design of fittings for ducts is required to conform to SMACNA, "HVAC Duct Construction Standards — Metal and Flexible", except that metal thickness is to conform to Table 6.2.4.2.

Table 6.2.4.2. Minimum Metal Thickness of Ducts
Forming Part of Sentence 6.2.4.2.(2)

TABLE 16-3

Type of Duct	Maximum Diameter, mm	Maximum Width or Depth, mm	Minimum metal thickness, mm	
			Duct Material	
			Galvanized Steel	Aluminum
Round ducts serving single *dwelling units*	125 or less	—	0.254	0.30
Round	350	—	0.33	0.30
	over 350	—	0.41	0.41
Rectangular, enclosed	—	350	0.33	0.30
	—	over 350	0.41	0.41
Rectangular, not enclosed, for single *dwelling units*, with required clearance up to 12 mm	—	350	0.33	0.41
	—	over 350	0.41	0.48
Rectangular, not enclosed, with required clearance of more than 12 mm	—	350	0.41	0.41
	—	over 350	0.48	0.48
Column 1	2	3	4	5

CONSTRUCTION AND INSTALLATION OF DUCTS AND PLENUMS

This topic has already been covered under the general Subsection 6.2.3. Air Duct Systems, earlier in this module.

Support

This topic has already been covered under the general Subsection 6.2.3. Air Duct Systems, earlier in this module.

Fire Stopping and Combustible Material

This topic has already been covered under the general Subsection 6.2.3. Air Duct Systems, earlier in this module.

Combustible ducts in concrete slabs-on-ground that are connected to a *furnace* supply *plenum* are to be located not closer than 600 mm to the *plenum* and not less than 600 mm from its connection to a riser or register as per Sentence 6.2.4.3.(8).

Moisture and Thermal Protection

This topic has already been covered under the general Subsection 6.2.3. Air Duct Systems, earlier in this module.

Where a *supply* or *return duct* is not protected by an insulated exterior wall or where the duct is exposed to an unheated space it is required by Sentence 6.2.4.3.(10) to be insulated to provide a thermal resistance of not less than RSI 2.1.

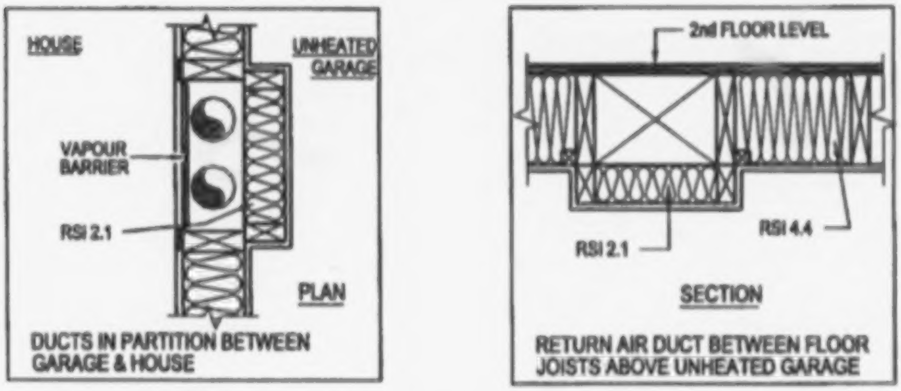

HOUSE
UNHEATED GARAGE
VAPOUR BARRIER
RSI 2.1
PLAN
DUCTS IN PARTITION BETWEEN GARAGE & HOUSE
2nd FLOOR LEVEL
RSI 4.4
RSI 2.1
SECTION
RETURN AIR DUCT BETWEEN FLOOR JOISTS ABOVE UNHEATED GARAGE

FIGURE 16-1

WARM-AIR SUPPLY OUTLETS

Article 6.2.4.4. requires that in a *dwelling unit*, a warm-air supply outlet is to be provided in each finished room that is located adjacent to unheated space, exterior air or exterior soil. When located adjacent to exterior walls, such outlets are to be located so as to bathe not less than one exterior wall or window with warm air, except in bathrooms, utility rooms or kitchens, where this may not be practical.

As an alternate to floor outlets, where the heating system is also designed to provide ventilation air, Sentence 6.2.4.4.(3) permits ceiling outlets or outlets located high on interior walls may be installed provided the outlets are

- designed for this purpose, and
- installed with diffusers.

Warm-air supply outlets located in finished areas are to be provided with diffusers and adjustable openings and must not be located on a *furnace plenum* as per Sentence 6.2.4.4.(9).

Number of Outlets Required

As per Article 6.2.4.4., not less than one warm-air supply outlet is to be provided for each 40 m^2 of floor surface area in unfinished *basements* serving *dwelling units*, located so as to provide adequate distribution of warm air throughout the *basement*. Not less than one warm-air supply outlet is to be provided for each 80 m^2 of floor surface area in heated crawl spaces.

Except for pipeless *furnaces* and floor *furnaces*, the capacity of warm-air supply outlets serving *dwelling units* must not be less than the design heat loss from the area served and must not exceed 3 kW per outlet.

In *basements* and heated crawl spaces, the calculated heat gain from the *supply ducts* and *plenum* surfaces is permitted by Article 6.2.4.4. to be considered in calculating the design heat loss, as a heat credit.

Maximum Temperature of Supply Air

As required by Article 6.2.4.4., the temperature of supply air at the warm-air supply outlets must not exceed 70°C.

No Interconnection with Storage Garage

Air duct systems serving *storage garages* must not be interconnected with other parts of the *building* as per Article 6.2.4.4.

CONCRETE SLABS-ON-GROUND

Article 6.2.4.5. requires warm -air supply systems for *buildings* of *residential occupancy* built on concrete slabs-on-ground are to be installed in the slab, and are to be of the perimeter loop type or radial perimeter type.

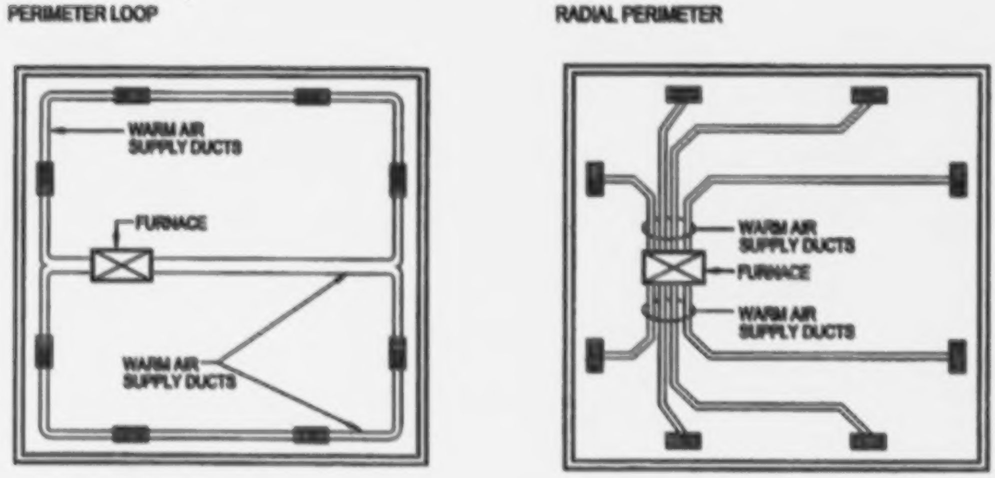

PERIMETER LOOP
WARM AIR SUPPLY DUCTS
FURNACE
WARM AIR SUPPLY DUCTS
RADIAL PERIMETER
WARM AIR SUPPLY DUCTS
FURNACE
WARM AIR SUPPLY DUCTS

FIGURE 16-2

ADJUSTABLE DAMPERS AND BALANCE STOPS

As per Article 6.2.4.6., all branch *supply ducts* for residential systems are to be equipped with volume control dampers at the boot to permit balancing or be fitted with a diffuser incorporating an adjustable and lockable volume control device which can be set in a fixed position.

RETURN-AIR SYSTEM

MATERIAL AND CLEARANCES

As per Article 6.2.4.7., the return-air system is to be designed to handle the entire air supply. The *return ducts* are to be constructed of material having a surface *flame-spread rating* of not more than 150, except for the following conditions where *noncombustible* ducts are required for:

- any part of a *return duct* exposed to radiation from the *furnace* heat exchanger or other radiating part of the *furnace*, such as part of a *return duct* directly above or within 600 mm of the outside *furnace* casing, and
- any *return ducts* serving solid fuel-fired *furnaces* are to be constructed of *noncombustible* material.

Combustible return ducts are to be lined with *noncombustible* material below floor registers, at the bottom of vertical ducts and under *furnaces* having a bottom return as per Sentence 6.2.4.7.(5).

Spaces between studs and joists used as *return ducts* are required by Sentence 6.2.4.7.(6) to be separated from the unused portions of such spaces by tight-fitting metal stops or wood blocking.

Vertical Return Duct Openings and Room Air Make-up

A vertical *return duct* is to have openings to return air on not more than 1 floor as per Article 6.2.4.7.

At least one return-air inlet is to be provided in each floor level in a *dwelling unit* except for floor levels that are less than 900 mm above or below an adjacent floor level which is provided with a return-air inlet as per Sentence 6.2.4.7.(11).

As required by Sentence 6.2.4.7.(12), provision is to be made for the return of air from all rooms by leaving gaps beneath doors, using louvered doors or installing *return duct* inlets.

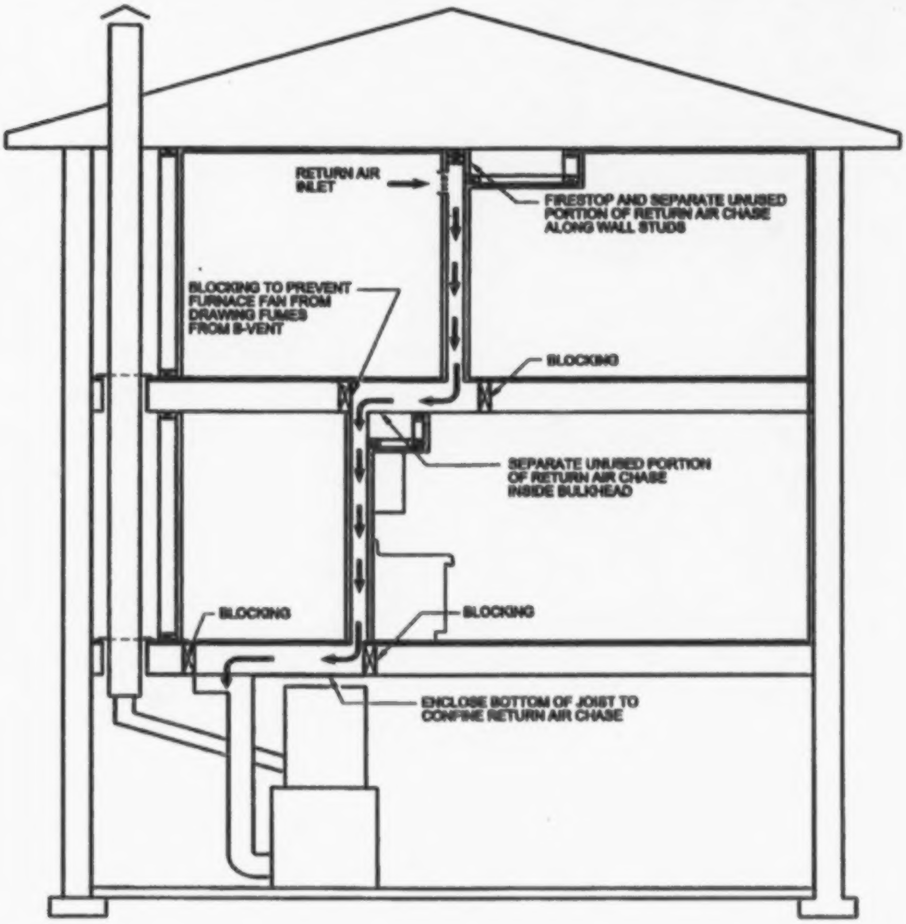

RETURN AIR INLET
FIRESTOP AND SEPARATE UNUSED PORTION OF RETURN AIR CHASE ALONG WALL STUDS
BLOCKING TO PREVENT FURNACE FAN FROM DRAWING FUMES FROM B-VENT
BLOCKING
SEPARATE UNUSED PORTION OF RETURN AIR CHASE INSIDE BULKHEAD
BLOCKING
BLOCKING
ENCLOSE BOTTOM OF JOIST TO CONFINE RETURN AIR CHASE

FIGURE 16-3

Negative Pressure and Recirculation

As per Sentence 6.2.4.7.(9), the return -air system is to be designed so that the negative pressure from the circulating fan cannot affect the *furnace* combustion air supply nor draw combustion products from joints or openings in the *furnace* or *flue pipe*.

Return-air from a *dwelling unit* must not be recirculated to any other *dwelling unit*.

EXAMPLE QUESTION

- During the installation of heating *supply ducts* a space between the duct and construction may be created. The space is to be fire stopped in which one of the following ways?
    - a) With wood blocking material at each end.
    - b) With noncombustible material, upstream end
    - c) With noncombustible material, floors only
    - d) With noncombustible material, at each end

OBC Reference ____________________

EXERCISE #16-8

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. When allowable duct materials are used in a location where they may be subjected to excessive moisture, which one of the following characteristics is required by the OBC?
    - a) Non-ferrous
    - b) Plastic
    - c) Equal wet/dry strength
    - d) Used only in horizontal runs

OBC Reference ____________________

2. Table 6.2.4.2 refers to "required clearance" which refers to installed clearance to combustible material. What minimum galvanized steel thickness is required for a rectangular, not enclosed, duct with a dimension of 400 mm width and 300 mm depth and required clearance of 12mm?
    - a) 0.48
    - b) 0.30
    - c) 0.41
    - d) 0.254

OBC Reference ____________________

3. In a *dwelling unit* a finished room of heat loss of 7.0 kW requires warm air supply. How many outlets are required to conform to the OBC.
    a) 1 outlet
    b) Design heat loss in kW divided by 3.0 kW and rounded to the next highest integer.
    c) 2 outlets, if two exterior walls have windows
    d) 2 outlets

OBC Reference ______________________

4. Which one of the following arrangements does the OBC NOT require *combustible* return air ducts to be lined with *noncombustible* material?
    a) Below floor registers
    b) At the bottom of vertical ducts
    c) At wood blocking in a horizontal run
    d) Under *furnaces* having a bottom return

OBC Reference ______________________

STOP

COVERINGS, LININGS AND INSULATION

As stated in Article 6.2.4.8., foamed plastic insulation may be used in a ceiling space that acts as a return air *plenum* provided the foamed plastic insulation is protected from exposure to the *plenum* in accordance with requirements described in Article 3.1.5.12. of the OBC.

Linings of ducts are to be installed so that they will not interfere with the operation of volume or balancing dampers.

Tape

This topic has already been covered under the general Subsection 6.2.3. Air Duct Systems, earlier in this module.

Clearances of Ducts and Plenums

Case 1

As per Sentence 6.2.4.10.(1), where the *plenum* clearance is 75 mm or less, the clearance between a *supply duct* and *combustible* material is

- to be equal to the required *plenum* clearance within 450 mm of the *plenum*, and
- to be not less than 12 mm at a distance of 450 mm or more from the *plenum*, except that this clearance may be reduced to zero beyond a bend or offset in the duct sufficiently large to shield the remainder of the duct from direct radiation from the *furnace* heat exchanger.

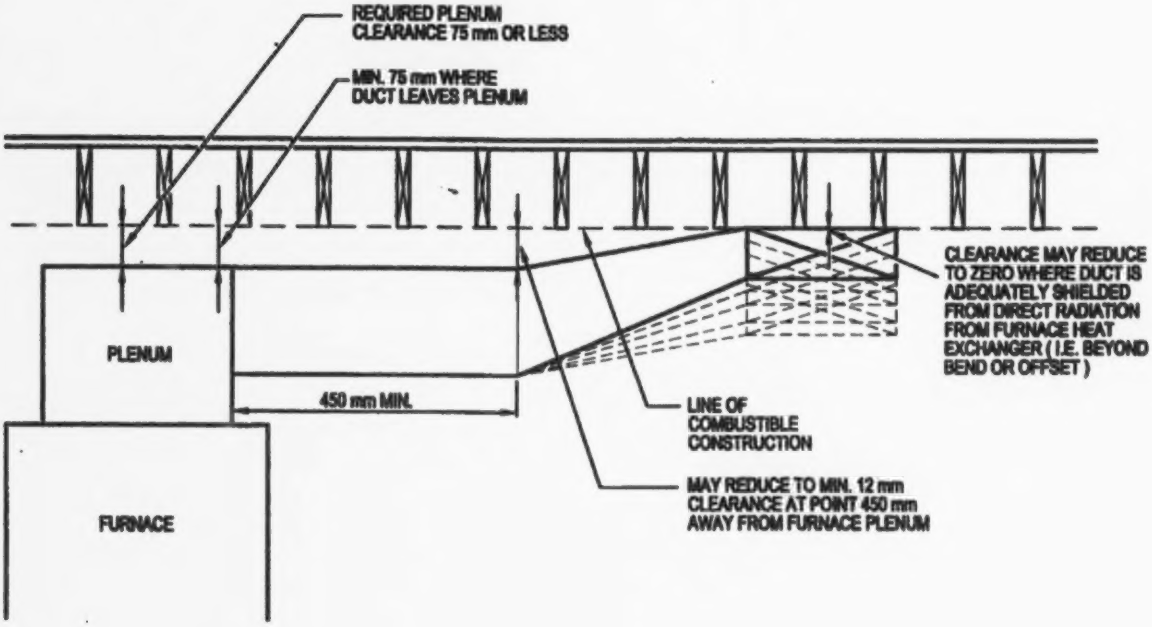

REQUIRED PLENUM CLEARANCE 75 mm OR LESS
MIN. 75 mm WHERE DUCT LEAVES PLENUM
CLEARANCE MAY REDUCE TO ZERO WHERE DUCT IS ADEQUATELY SHIELDED FROM DIRECT RADIATION FROM FURNACE HEAT EXCHANGER (I.E. BEYOND BEND OR OFFSET)
PLENUM
450 mm MIN.
LINE OF COMBUSTIBLE CONSTRUCTION
FURNACE
MAY REDUCE TO MIN. 12 mm CLEARANCE AT POINT 450 mm AWAY FROM FURNACE PLENUM

FIGURE 16-5

Case 2

As per Sentence 6.2.4.10.(2), where the *plenum* clearance is more than 75 mm but not more than 150 mm, the clearance between a *supply duct* and *combustible* material is

- to be equal to the required *plenum* clearance within a horizontal distance of 1800 mm of the *plenum*, and
- to be not less than 12 mm at a horizontal distance of 1800 mm or more from the *plenum*, except that this distance may be reduced to zero beyond a bend or offset in the duct sufficiently large to shield the remainder of the duct from direct radiation from the *furnace* heat exchanger.

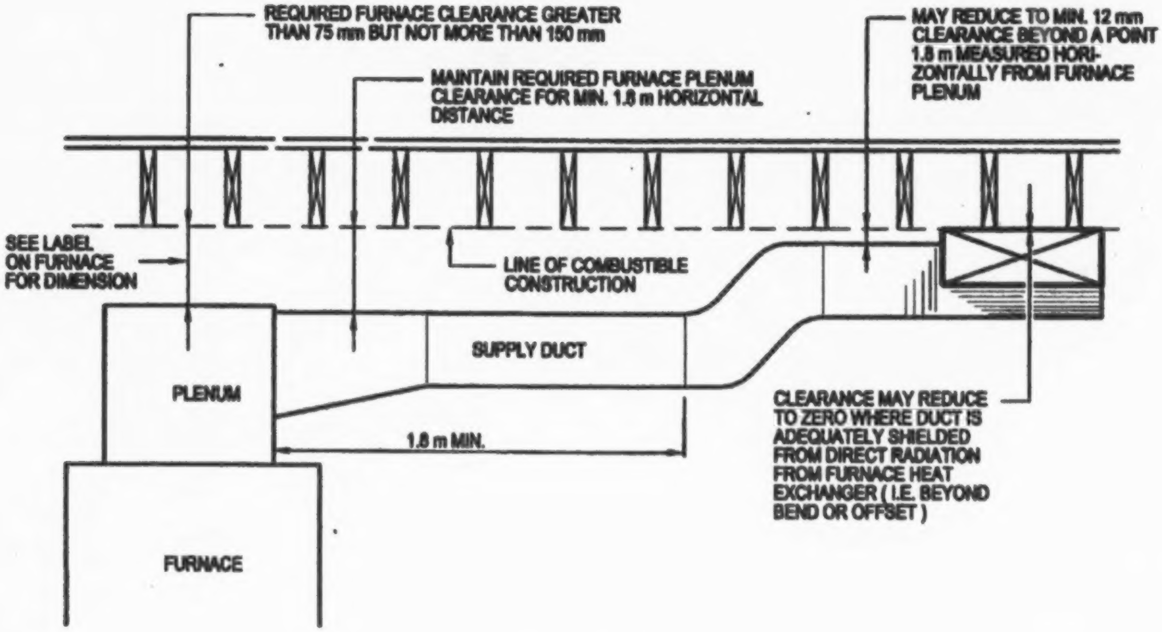

REQUIRED FURNACE CLEARANCE GREATER THAN 75 mm BUT NOT MORE THAN 150 mm
MAINTAIN REQUIRED FURNACE PLENUM CLEARANCE FOR MIN. 1.8 m HORIZONTAL DISTANCE
MAY REDUCE TO MIN. 12 mm CLEARANCE BEYOND A POINT 1.8 m MEASURED HORIZONTALLY FROM FURNACE PLENUM
SEE LABEL ON FURNACE FOR DIMENSION
LINE OF COMBUSTIBLE CONSTRUCTION
SUPPLY DUCT
PLENUM
1.8 m MIN.
CLEARANCE MAY REDUCE TO ZERO WHERE DUCT IS ADEQUATELY SHIELDED FROM DIRECT RADIATION FROM FURNACE HEAT EXCHANGER (I.E. BEYOND BEND OR OFFSET)
FURNACE

FIGURE 16-6

Case 3

As per Sentence 6.2.4.10.(3), where the *plenum* clearance is more than 150 mm, the clearance between a *supply duct* and *combustible* material is

- to be equal to the required *plenum* clearance within a horizontal distance of 1000 mm of the *plenum*,
- to be not less than 150 mm within a horizontal distance between 1000 mm and 1800 mm from the *plenum*, and
- to be not less than 25 mm at a horizontal distance of 1800 mm or more from the *plenum*, except that this distance may be reduced to 8 mm beyond a bend or offset in the duct sufficiently large to shield the remainder of the *supply duct* from direct radiation from the *furnace* heat exchanger.

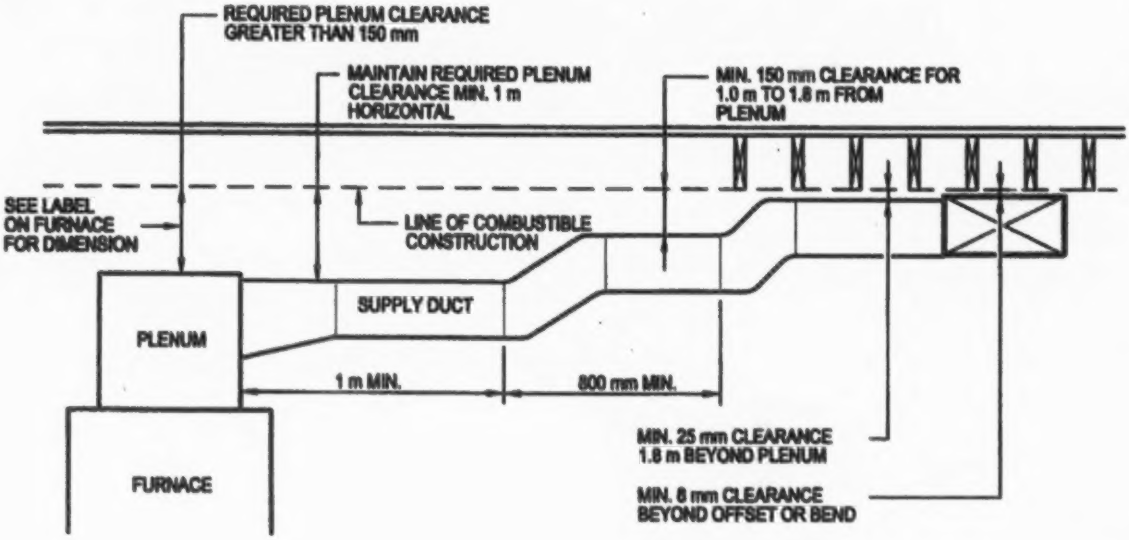

REQUIRED PLENUM CLEARANCE GREATER THAN 150 mm
MAINTAIN REQUIRED PLENUM CLEARANCE MIN. 1 m HORIZONTAL
MIN. 150 mm CLEARANCE FOR 1.0 m TO 1.8 m FROM PLENUM
SEE LABEL ON FURNACE FOR DIMENSION
LINE OF COMBUSTIBLE CONSTRUCTION
SUPPLY DUCT
PLENUM
1 m MIN.
800 mm MIN.
MIN. 25 mm CLEARANCE 1.8 m BEYOND PLENUM
FURNACE
MIN. 8 mm CLEARANCE BEYOND OFFSET OR BEND

FIGURE 16-7

Pipeless Furnace

Where a register is installed in a floor directly over a pipeless *furnace*, a double-walled register box with not less than 100 mm between walls, or a register box with the warm-air passage completely surrounded by the cold-air passage, is be permitted despite the three clearances conditions listed above as per Article 6.2.4.10.

Exhaust Ducts and Outlets

Where an *exhaust duct* passes through or is adjacent to unheated space, the duct is required by Article 6.2.4.11. to be insulated to prevent moisture or condensation in the duct. Exhaust outlets are to be designed to prevent back draft under wind conditions.

Exhaust ducts directly connected to laundry drying equipment must be independent of other *exhaust ducts*.

Make-up Air

This topic has already been covered under the general Subsection 6.2.3. Air Duct Systems, earlier in this module.

Electric Resistance Heating

As per Sentence 6.2.4.12.(2), when electric resistance heating is used to temper make-up air in *buildings* of *residential occupancy* (Part 9), the energy rating for windows and sliding glass doors and the minimum thermal resistance of insulation installed must conform to special requirements described in the OBC. However these special OBC requirements need not be met where *electric space heating* is provided, or a heat recovery ventilator is installed, which meets the minimum rating requirements discussed earlier in this module as per Sentence 6.2.4.12.(3).

Supply, Return, Intake and Exhaust Air Openings

Article 6.2.4.13. requires supply, return and exhaust air openings in rooms or spaces are to be protected by grilles having openings of a size that will not allow the passage of a 15 mm diameter sphere.

Outdoor air intakes and exhaust outlets at the *building* exterior are to be designed or located so that the air entering the *building* system will not contain more contaminants than the normal exterior air.

Screens

This topic has already been covered under the general Subsection 6.2.3. Air Duct Systems, earlier in this module.

Air Filters and Equipment

This topic has already been covered under the general Subsection 6.2.3. Air Duct Systems, earlier in this module.

Odour Removal Equipment

This topic has already been covered under the general Subsection 6.2.3. Air Duct Systems, earlier in this module.

Heating Appliances, General

Location of Appliances

Except for *appliances* installed in *dwelling units*, fuel-fired heating *appliances* are to be located, enclosed or separated from the remainder of the *building* in conformance with Section 3.6. Service Facilities as per Article 6.2.5.1.

Appliances Installed Outside the Building

Article 6.2.5.2. requires fuel -fired *appliances* installed on the roof of a *building* or otherwise outside the *building* are to be

- designed for outdoor use,
- installed not less than 1 200 mm from the property line, measured horizontally, and
- installed not less than 3 m from an adjacent wall of the same *building* when such wall contains an opening or openings within 3 *storeys* above and 5 m horizontally from the *appliance*, unless such openings are protected by a *closure* assembly having a 45 min *fire-protection rating* determined in conformance with Article 3.1.8.4.,

or by wired glass conforming to Article 3.1.8.14.

Carbon Monoxide Alarms

Application

As stated in Article 6.2.12.1., the provisions described below apply to every *building* that contains a *residential occupancy* and contains a fuel-burning *appliance* or a *storage garage*.

Location of Carbon Monoxide Alarms

Where a fuel-burning *appliance* is installed in a *suite* of *residential occupancy*, a carbon monoxide alarm is to be installed adjacent to each sleeping area in the *suite*.

Where a fuel-burning *appliance* is installed in a *service room* that is not in a *suite* of *residential occupancy*, a carbon monoxide alarm shall be installed

- adjacent to each sleeping area in every *suite* of *residential occupancy* that is adjacent to the *service room*, and
- in the *service room*.

Where a *storage garage* is located in a building containing a *residential occupancy*, a carbon monoxide alarm is to be installed adjacent to each sleeping area in every *suite* of *residential occupancy* that is adjacent to the *storage garage*.

Installation and Conformance to Standards

A required carbon monoxide alarm is to

- be permanently connected to an electrical circuit and shall have no disconnect switch between the overcurrent device and the carbon monoxide alarm,
- be wired so that its activation will activate all carbon monoxide alarms within the *suite*, where located within a *suite* of *residential occupancy*,
- be equipped with an alarm that is audible within bedrooms when the intervening doors are closed, where located in a *suite* of *residential occupancy*, and

conform to

- CAN/CSA 6.19, "Residential Carbon Monoxide Alarming Devices", or
- UL 2034, "Single and Multiple Station Carbon Monoxide Detectors".

Incinerators

Applicable Standard

As stated in Article 6.2.6.1., the design, construction, installation and *alteration* of every indoor incinerator is to conform to NFPA 82, "Incinerators, Waste and Linen Handling Systems and Equipment".

STOP

EXAMPLE QUESTION

- Which one of the following methods is used to determine the required plenum clearance for a *furnace*?
  - a) Use Part 9 OBC.
  - b) Good engineering practice.
  - c) Use Part 6 OBC.
  - d) From equipment data label.

OBC Reference ______________________________

EXERCISE #16-9

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. Where a required *plenum* clearance is more than 150 mm, which of the following arrangements allows the required *plenum* clearance to be reduced to zero at a point more than 1.8 m from the *furnace plenum*?
    a) Insertion of a further 1.8 m.
    b) Insertion of 450 mm of 12 mm clearance.
    c) Insertion of required bend or offset.
    d) Zero clearance not allowed.

OBC Reference ______________________________

2. In odour removal equipment, the adsorption material is to be protected from dust accumulation by air filters installed in which one of the following arrangements?
    a) Installed on the air inlet side
    b) Installed on the air discharge side
    c) Installed only when the adsorption material is out of the unit being reactivated
    d) Installed in a manner that, when removed, will automatically de-energize power to the system.

OBC Reference ______________________________

3. A *suite* of *residential occupancy* contains a fuel-burning *appliance*. A carbon monoxide detector is to be installed in which one of the following areas?
    a) in a garage;
    b) in a service room;
    c) adjacent to each sleeping area in the *suite;*
    d) in the main living area.

OBC Reference ______________________________

4. Which one of the following is a conformance standard for carbon monoxide detector?
   - a) CAN/CGA-6.19
   - b) CAN4-S111-M
   - c) CAN/CSA 6.19
   - d) ASHRAE 62

OBC Reference ______________________________

Unit Heaters – Clearances

Every *unit heater* using either steam or hot water as the heating medium is to be installed with a clearance between the *appliance* and adjacent *combustible* material meeting OBC Table 6.2.9.3 as per Article 6.2.7.1.

Radiators and Convectors – Lining or Backing

As required by Article 6.2.8.1., every steam or hot water radiator and convector located in a recess or concealed space or attached to the face of a wall of *combustible construction* is to be provided with a *noncombustible* lining or backing.

Every steam or hot water radiator and convector is to be installed with a clearance between the *appliance* and adjacent *combustible* material meeting OBC Table 6.2.9.3.

Piping for Heating and Cooling Systems

Piping Materials and Support

Article 6.2.9.1. requires that piping must be made from materials designed to withstand the effects of temperatures and pressures that may occur in the system. Every pipe used in a heating or *air-conditioning* system is to be installed to allow for expansion and contraction due to temperature changes.

Supports and anchors for piping in a heating or *air-conditioning* system are to be designed and installed to ensure that undue stress is not placed on the supporting structure.

Insulation of Piping for Heating and Cooling Systems

Insulation for Human Contact

Pipes that are exposed to human contact must be insulated so that the exposed surface does not exceed 70°C as per Article 6.2.9.2.

Insulation and Covering

As per Article 6.2.9.2., insulation and coverings on pipes are to be composed of material suitable for the operating temperature of the system to withstand deterioration from softening, melting, mildew and mould.

Insulation and coverings on pipes in which the temperature of the fluid exceeds 120°C are to be made of *noncombustible* material or not flame, glow, smoulder or smoke when tested in accordance with the method of test ASTM C411, "Hot-Surface Performance of High-Temperature Thermal Insulation" in accordance with Article 6.2.9.2. The performance test is to be conducted at the maximum temperature to which the insulation or covering may be exposed to in service.

Combustible Insulation

Where *combustible* insulation is used on piping in a *horizontal or vertical service space*, the insulation and coverings on such pipes are required by Article 6.2.9.2. to have a *flame-spread rating* throughout the material of not more than 25 in a *building* of *noncombustible construction* and not more than 75 in *buildings* of *combustible construction*.

Where *combustible* insulation is used on piping in buildings described in Subsection 3.2.6., they shall have a smoke developed classification of not more than 100. Insulation and coverings on piping located in rooms and spaces other than the *service spaces* described above are to have a *flame-spread rating* of not more than that required for the interior finish for the ceiling of the room or space.

As per Sentence 6.2.9.2.(7), no *flame-spread rating* or smoke developed classification limitations are required where *combustible* insulation and coverings are used on piping when such piping is

- located within a concealed space in a wall,
- located in a floor slab, or
- enclosed in a *noncombustible* raceway or conduit.

Clearances – Combustible Materials

As required by Article 6.2.9.3., clearances between *combustible* material and bare pipes carrying steam or hot water are to conform to Table 6.2.9.3.

Table 6.2.9.3. Clearance between Steam or Hot Water Pipes and Combustible Material
Forming Part of Sentence 6.2.9.3.(1)

Steam or Water Temperature, °C	Minimum Clearance, mm
up to 95	no clearance
above 96 to 120	15
above 120	25
Column 1	2

Surface Temperature

The exposed surface temperature of a steam or hot water radiator must not exceed 70°C unless precautions are taken to prevent human contact as per Article 6.2.9.4.

Protection of Structure and Materials – High Temperature

As per Article 6.2.9.5., where a pipe carrying steam or hot water at a temperature above 120°C passes through a *combustible* floor, ceiling or wall, the construction is to be protected by a sleeve of metal or other *noncombustible* material not less than 50 mm larger in diameter than the pipe.

Unprotected steam or hot water pipes that pass through a storage space must be covered with not less than 25 mm of *noncombustible* insulation to prevent direct contact with the material stored as required by Article 6.2.9.5.

Refrigerating Systems & Equipment for Air-Conditioning

Cooling Units

As required by Article 6.2.10.1, where a cooling unit is combined with a fuel-fired *furnace* in the same duct system, the cooling unit is to be installed

- in parallel with the heating *furnace*,
- upstream of the *furnace* provided the *furnace* is designed for such application, or
- downstream of the *furnace* provided the cooling unit is designed to prevent excessive temperature or pressure in the refrigeration system.

Storage Bins

Service pipes passing through a storage bin for solid fuel are to be protected or so located as to avoid damage to the pipes as per Article 6.2.11.1.

Except for fuel-thawing pipes, every pipe designed to operate at a temperature of 50°C or above must be located where fuel cannot be stored in contact with it.

A storage bin for solid fuel must not be located above a sewer opening or drain opening.

Storage bins for solid fuel are to be designed and constructed so that the air temperature in the bin or the surface temperature of any part of the floor or walls is below 50°C.

Ash Storage Bins

Every ash storage bin is to be constructed of *noncombustible* material as per Article 6.2.11.2.

Every opening in an ash storage bin is to be protected by a tight-fitting metal door with metal frame securely fastened to the bin.

Chimneys and Venting Equipment – Requirement for Venting

Article 6.3.1.1 requires the products of combustion from solid fuel-burning *appliances* are to be vented in conformance with the requirements of CAN/CSA-B365-M, "Installation Code for Solid Fuel-Burning Appliances and Equipment".

Masonry or Concrete Chimneys

As per Article 6.3.1.2., rectangular *masonry or concrete chimneys* not more than 12 m in height are to conform to Part 9 of the OBC if they serve *appliances* with a combined total rated heat output of 120 kW or less, or fireplaces.

Metal Smoke Stacks

Single wall metal smoke stacks are to be designed and installed in conformance with NFPA 211, "Standard for Chimneys, Fireplaces, Vents and Solid Fuel-Burning Appliances" in accordance with Article 6.3.1.3.

Access Ladders

As required by Article 6.3.1.5, Access ladders for *chimneys*, when provided, are to consist of steel or bronze rungs, built into the walls of the *chimneys*.

Rungs for external ladders are to begin at not less than 2500 mm from ground level.

STOP

EXAMPLE QUESTION

- Which of the following physical characteristic of the supply air of a *furnace* provided with a downstream cooling unit is to be considered in the design of the refrigeration system?
  - a) Air humidity
  - b) Air pressure
  - c) Air temperature
  - d) Air dust level

OBC Reference ________________________________

EXERCISE #16-10

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. Where combustible insulation is used on piping in a horizontal or vertical service space in buildings of combustible construction, the insulation and coverings are to have a flame-spread rating of not more than?
   - a) required for the interior finish for the ceiling of the room or space.
   - b) 70
   - c) zero, no *flame-spread rating* required
   - d) 75

OBC Reference ________________________________

2. An enclosed ash storage bin is located in a *building*. Which one of the following materials conforms to the OBC requirement for the construction of the ceiling in the room in which it is located?
   - a) *Noncombustible* only.
   - b) *Combustible* and *Noncombustible*
   - c) *Combustible* only.
   - d) *Combustible* or *Noncombustible*

OBC Reference ________________________________

3. Which one of the following is to be vented in conformance with the requirements of CAN/CSA-B365-M, "Installation Code for Solid Fuel-Burning Appliances and Equipment?
    a) nonsolid-fuel burning *appliance*;
    b) direct fired fireplace;
    c) woodstove;
    d) direct-vented water heater.

OBC Reference ______________________________

4. Chimneys and venting equipment may have access ladders for maintenance and inspection. Rungs for external ladders are to?
    a) be removable up to 2500 mm from ground;
    b) begin at not less than 2500 mm from ground level;
    c) begin at not more than 2500 mm from ground level;
    d) be constructed of corrosion resistant aluminum.

OBC Reference ______________________________

STOP

Ontario Ministry of Municipal Affairs and Housing

BUILDING SERVICES

PARTICIPANT'S MODULE #17

Heating, Ventilating and Air-Conditioning for Housing and Small Buildings

JAN06

INTRODUCTION

This module covers the core concept of ventilation in a *building*. Natural ventilation in *residential occupancies* and mechanical ventilation serving one *dwelling unit* is the major focus. Requirements for ventilation area, exhaust, intake, equipment, ducting, arrangement, and design are all examined.

OBJECTIVES

Upon completion of this module participants will be able to:

- Determine applicable *building* classifications and room and space types for OBC ventilation measures;
- Calculate natural ventilation requirements for buildings of *residential occupancies;*
- Know and understand the requirements for mechanical ventilation for single *dwelling units;*
- Calculate the requirements for mechanical ventilation;
- Determine the requirements for ducts, heat recovery ventilators, and their installation;
- Identify the requirements for outdoor intake and exhaust openings.

STOP

NATURAL AND MECHANICAL VENTILATION – OBC PART 9

This module covers the ventilation of rooms and spaces in *residential occupancies* by natural ventilation (Subsection 9.32.1.). This module also covers self-contained mechanical ventilation systems serving only one *dwelling unit* (OBC Part 9).

Exclusions

- Natural ventilation of rooms and spaces in other than *residential occupancies* is to conform to OBC Part 6 and is not covered in this module.

- Mechanical ventilation systems, other than self-contained systems serving single *dwelling units* are to conform to OBC Part 6 and are not covered in this module.
- *Storage garages* for more than 5 cars, are to be ventilated in accordance with Part 6 of the OBC.
- Where unheated crawl spaces in Part 9 buildings are ventilated by natural means, ventilation is to be provided with not less than 0.1 m^2 of unobstructed uniformly distributed vent area for every 50 m^2 of *floor area* (designed to prevent the entry of snow, rain and insects).

Natural Ventilation Area for Rooms and Spaces

As per Article 9.32.2.1., the unobstructed openable ventilation area to the outdoors for rooms and spaces in residential *buildings* ventilated by natural means is to conform to Table 9.32.2.1.

Table 9.32.2.1. Natural Ventilation
Forming Part of Sentence 9.32.2.1.(1)

TABLE 17-1

Location		Minimum Unobstructed Area
Within *dwelling unit*	Bathrooms or water closet rooms	0.09 m^2
	Unfinished *basement* space	0.2 per cent of the floor area
	Dining rooms, living rooms, bedrooms, kitchens, combined rooms, dens, recreation rooms and all other finished rooms	0.28 m^2 per room or combination of rooms
Other than within *dwelling unit*	Bathrooms or water closet rooms	0.09 m^2 per water closet
	Sleeping areas	0.14 m^2 per occupant
	Laundry rooms, kitchens, recreation rooms	4 per cent of the floor area
	Corridors, storage rooms and other similar public rooms or spaces	2 per cent of the floor area
	Unfinished *basement* space not used on a shared basis	0.2 per cent of the floor area
Column 1	2	3

Where a vestibule opens directly off a living or dining room within a *dwelling unit*, ventilation to the outdoors for such rooms may be through the vestibule.

Where a room or space is not provided with natural ventilation area, mechanical ventilation is to be provided to exhaust inside air from or to introduce outside air to that room or space at the rate of

- one-half air change per hour if the room or space is mechanically cooled in summer, and
- one air change per hour if it is not.

Note that other requirements of the OBC may dictate that openable windows are required for rooms or spaces, example; bedroom areas.

Protection from Weather and Insects

Openings for natural ventilation other than windows are to be constructed to provide protection from the weather and insects as per Article 9.32.2.2.

Screening is to be of rust-proof material.

STOP

EXAMPLE QUESTION

- This module covers OBC Section 9.32 Ventilation. Which one of the following represents an accurate summary of the scope of 9.32?
  - a) house ventilation
  - b) natural ventilation and mechanical ventilation of rooms and spaces in *residential occupancies* (Part 9 *buildings)*
  - c) rooms and spaces in *residential occupancies* by natural ventilation and mechanical ventilation serving only one *dwelling unit* (both in Part 9 *buildings)*
  - d) natural ventilation of rooms and spaces in other than *residential occupancies* and mechanical ventilation of *dwelling units*

OBC Reference ______________________________

EXERCISE #17-1

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. A single-family house is air-conditioned (mechanically cooled) and has a basement that contains three finished rooms of 10 m^2 and unfinished *basement* space of 14 m^2. What is the minimum unobstructed area required for natural ventilation of the unfinished *basement* space?
   - a) 0.028 m^2
   - b) 0.020 m^2
   - c) 0.030 m^2
   - d) 0.014 m^2

OBC Reference ______________________________

2. The house in Question #1 provides mechanical ventilation instead of natural ventilation for the finished *basement* space. Assuming that the finished ceiling height in the basement is 2.5 m, what is the minimum required mechanical ventilation airflow rate in m^3 per hour for each room?
    a) 25.0;
    b) 0.50;
    c) 12.5;
    d) 1.00.

OBC Reference ________________________

3. A single-family home is not air-conditioned and has a living room with fixed windows. The room area is 18 m^2. Assuming a 2.5 m ceiling height, what is the required minimum mechanical ventilation airflow rate in m^3/min?
    a) 1.5;
    b) 0.75;
    c) 3.0;
    d) 0.38.

OBC Reference ________________________

MECHANICAL VENTILATION FOR DWELLING UNITS

Every *dwelling unit* that is supplied with electrical power is to be provided with a mechanical ventilation system.

Fuel-fired Appliance and Dwelling Unit Catorgization

As described in Article 9.32.3.1., a non -solid fuel-fired *appliance* is classified as

- direct vented; if the combustion air is supplied directly from the outdoors to the combustion chamber via a sealed passageway, and the products of combustion are exhausted directly outdoors through an independent sealed vent,

- mechanically vented induced draft; if the combustion air is supplied from within the *building* envelope and the products of combustion are positively conveyed to the outdoors by means of a dedicated sealed vent, or
- natural draft; if combustion air is supplied from within the *building* envelope and the products of combustion are conveyed to the outdoors through a *chimney* or Type B vent.

A *dwelling unit* is to be categorized as:

Type I

When all fuel-fired combustion *appliances* located in the *dwelling unit* are

- direct vented , or
- mechanically vented induced draft (excluding fireplaces), or
- the *dwelling unit* does not contain a solid fuel-fired combustion *appliance*.

Type II

When a solid fuel-fired combustion *appliance* is installed in a Type I *dwelling unit*,

Type III

When a mechanically vented induced draft non-solid fuel-fired fireplace or a natural draft *appliance* is present, or

Type IV

When *electric space heating* is present.

Required Mechanical Ventilation

The required mechanical ventilation system for each *dwelling unit* Type is required by Article 3.32.3.2. to conform to

- Part 6 OBC for all Types of dwelling units, or optionally
- Part 9 OBC for Type I, Type II or Type IV *dwelling unit*.

Seasonal Recreational Buildings

The OBC provides exclusions for *buildings* (9.36.2.1.) used or intended to be used as seasonal recreational *buildings*, in particular to this module, mechanical ventilation need not be provided. However, where mechanical ventilation is provided in the *building*, it is to comply with the related requirements of Part 9 OBC.

Total Ventilation Capacity

As required by Article 9.32.3.3., the minimum total ventilation capacity of the ventilation system required is to be the sum of the individual room capacities given in Table 9.32.3.3.

Table 9.32.3.3. Ventilation Capacity

Forming Part of Sentence 9.32.3.3.(1)

TABLE 17-2

Room	Capacity, L/s
Master bedroom[1]	10
Other bedrooms	5
Living room[2]	5
Dining room[2]	5
Kitchen	5
Family Room[2]	5
Recreation room	5
Basement[3]	10
Other habitable rooms[4]	5
Bathroom or water closet room	5
Laundry room	5
Utility room	5
Column 1	2

Notes to Table 9.32.3.3.:

[1] At least one bedroom in each *dwelling unit* is to be designated as the master bedroom.

[2] Ventilation capacities assigned to any combined living/dining or family/dining space is to be determined as if the spaces were individual rooms.

[3] Where a *basement* incorporates rooms of the types designated in this Table, the assigned ventilation capacities for each room is to be as specified for those types of rooms. *Basement* areas used for other purposes that exceed 2/3 of the total *basement* floor area are to be assigned a fan capacity of 10 L/s. Those that are less than 2/3 of the total floor area are to be assigned 5 L/s.

[4] Other habitable rooms are to be assigned a ventilation capacity of 5 L/s. This does not include spaces intended solely for access, egress, storage or service equipment.

Clarification to Table 9.32.3.3 notes include

- combined rooms are assigned ventilation capacities as if they were separate spaces
- listed room types located in basements are assigned their listed capacities
- generally, basements with any habitable rooms will be assigned a total ventilation capacity greater than the listed value for basements alone
- non-listed habitable rooms do not include spaces intended solely for access, egress, storage, or service equipment

STOP

EXAMPLE QUESTION

- A non-solid fuel-fired *appliance* is supplied with combustion air from within the *building* envelope and its products of combustion are positively conveyed to the outdoors by means of a dedicated sealed vent. It would be classified as?
  - a) direct vented
  - b) natural draft
  - c) Type II
  - d) mechanically vented induced draft

OBC Reference ______________________________

EXERCISE #17-2

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. Which one of the following would NOT be present in a Type I *dwelling unit*?
   - a) mechanically vented induced draft combustion *appliance*
   - b) direct vented non-solid fuel-fired fireplace
   - c) direct vented combustion *appliance*
   - d) mechanically vented induced draft non-solid fuel-fired fireplace

OBC Reference ______________________________

2. Which *dwelling unit* "Type" does not have an option of conformance with Subsection 9.32.3 Mechanical Ventilation?
   - a) Type I;
   - b) Type III;
   - c) Type IV;
   - d) Type II.

OBC Reference ______________________________

3. A *dwelling unit* contains;

   a combination living/dining room,
   a kitchen,
   a family room,
   a master bedroom,
   a washroom
   two other bedrooms,
   a ski storage room,
   a laundry room
   and a basement,

   What is the minimum total ventilation capacity (in L/s) of the ventilation system according to Table 9.32.3.3.?
   a) 55
   b) 60
   c) 65
   d) 70

OBC Reference ______________________________

4. Which one of the following would be considered a habitable room?
   a) service equipment room
   b) sewing room
   c) main entrance vestibule
   d) walk-in pantry

OBC Reference ______________________________

STOP

PRINCIPAL EXHAUST

A principal exhaust fan is to be installed and is to be rated to provide not less than the capacity given in Table 9.32.3.4.A.

Table 9.32.3.4.A. Principal Exhaust Fan Capacity

Forming Part of Sentence 9.32.3.4.(1)

TABLE 17-3

Number of Bedrooms in *Dwelling Unit*	Capacity, L/s
1	15
2	22.5
3	30
4	37.5
More than 4	Part 6 design
Column 1	2

Principal Exhaust Control and Capacity Adjustment

The requirements for principal exhaust can be found in Article 9.32.3.4.

The principal exhaust fan is to be controlled by a manual switch, centrally located in the *dwelling unit* and to be identified with the words VENTILATION FAN.

Where the installed capacity of the principal exhaust fan exceeds the minimum capacity required by more than 50%, the fan control manual switch is to include provision to allow reduction of the flow to within ±10% of the minimum capacity required.

A principal exhaust fan may be controlled by a dehumidistat or other automatic control device where the required manual switch is capable of activating the fan regardless of the setting of the automatic control.

The principal exhaust may be provided by means of a heat recovery ventilator installed in accordance with Part 9 OBC.

Principal Exhaust Fan Intake Location

As per Sentence 9.32.3.4., where an exhaust air intake for the principal exhaust fan is connected directly to the duct system of a forced air heating system or other central air circulating system, it is to

- be connected to the return air side of the system, and
- be connected not less than 1000 mm upstream from any outdoor air supply duct.

Where an exhaust air intake for the principal exhaust fan is located in the kitchen, it is to be located in the ceiling or on the wall within 300 mm of the ceiling.

Principal Exhaust Duct Sizing

As required by Article 9.32.3.4., single or multiple *exhaust ducts* serving the principal exhaust fan required by Sentence 9.32.3.4.(1) are to be sized according to Part 6 OBC except that they may be sized according to Table 9.32.3.4.B. where

- the longest total duct length, from intake grille to outdoor hood, does not exceed 12 m, and
- the number of elbows does not exceed 4,
- and, in any case, the duct must not to be smaller than recommended by the manufacturer of the fan.

Table 9.32.3.4.B.Principal Exhaust Duct Size
Forming Part of Sentence 9.32.3.4.(9)

TABLE 17-4

Number of Bedrooms in *Dwelling Unit*	Minimum *Exhaust Duct* Diameter			
	Ducts Connected to Inlet and Outlet of Principal Exhaust Fan		Ducts Connected to One Side Only of Principal Exhaust Fan	
	Smooth Duct, Mm	Flexible Duct, Mm	Smooth Duct, Mm	Flexible Duct, mm
1	100	125	100	125
2	125	150	125	150
3	125	150	150	175
4	150	175	150	175
More than 4	Part 6 Design	Part 6 Design	Part 6 Design	Part 6 Design
Column 1	2	3	4	5

In applying Table 9.32.3.4.B.

- where there is more than one exhaust air inlet duct connected directly to the fan, the diameter of the inlet ducts may be decreased by 25 mm, and
- where the *exhaust duct* is connected to the duct system of a forced air heating system, the duct diameter is to be increased by 25 mm.

STOP

EXAMPLE QUESTION

- A single family home has a second floor with three bedrooms and a partially finished *basement* with one bedroom. What is the minimum capacity for a required principal exhaust fan?
    a) 30
    b) 22.5
    c) 37.5
    d) Determined by Part 6 design

OBC Reference ______________________________

EXERCISE #17-3

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. A principal exhaust fan may be controlled by a dehumidistat or other automatic control device. Which one of the following operational characteristic is required by the OBC?
   a) maintains humidity to +/- 10%
   b) manual switch is capable of activating the fan regardless of the state of the automatic control.
   c) 100% capacity control is available.
   d) automatic shut-off with timer

OBC Reference ______________________________

2. Which one of the following is a requirement of the OBC when an exhaust air intake for the principal exhaust fan is connected directly to the duct system of a forced air heating system or other central air circulating system?
   a) connected to the supply side of the system
   b) connected not more than 1000 mm upstream from any outdoor air supply duct
   c) located in the ceiling or on the wall within 300 mm of the ceiling
   d) connected not less than 1000 mm upstream from any outdoor air supply duct

OBC Reference ______________________________

3. For the purpose of Article 9.32.3.4. Principal Exhaust, a principal exhaust system has ducts connected to one side only of the principal exhaust fan. If the system is installed in a *dwelling unit* with two bedrooms, what is the minimum *exhaust duct* diameter (in mm) if flexible duct is used?
   a) 150
   b) 125
   c) 175
   d) 100

OBC Reference ______________________________

4. For the system arrangement described in Question # 3 the *exhaust duct* is connected to the duct system of a forced air heating system. What adjustment to the duct diameter (in mm) is required?
    a) decrease by 25
    b) increase by 12
    c) increase by 25
    d) no adjustment required

OBC Reference ______________________________

STOP

SUPPLEMENTAL EXHAUST

Additional supplemental exhaust capacity is required by Article 9.32.3.5. to be installed as necessary so that the total capacity of all kitchen, bathroom, water closet room and other supplemental exhaust air inlets is not less than the total ventilation capacity, as calculated from Table 9.32.3.3., minus the principal exhaust fan capacity, as calculated from Table 9.32.3.4.A.

Supplemental Exhaust Fan Intake Location

As per Article 9.32.3.5., an exhaust air intake is to be installed in each kitchen, bathroom and water closet room.

Where the intake for a supplemental exhaust fan other than a range hood or range-top fan is installed in a kitchen, it is to be installed in the ceiling or on the wall within 300 mm of the ceiling.

Supplemental Exhaust Duct Sizing

Exhaust ducts serving the required kitchen, bathroom, water closet room and other supplemental exhaust air inlets are required by Article 9.32.3.5. to be sized according to Part 6 OBC except that they may be sized according to Table

9.32.3.5. where

- the total duct length does not exceed 9 m, and
- the number of elbows does not exceed 4,

and, in any case, they must not be smaller than recommended by the manufacturers of the fans.

Table 9.32.3.5. Kitchen, Bathroom and Water Closet Room Exhaust Duct Size
Forming Part of Sentence 9.32.3.5.(4)

TABLE 17-5

Fan Capacity, L/s	Minimum *Exhaust Duct* Diameter[1]	
	Ducts Connected to Inlet & Outlet of Exhaust Fan, mm	Ducts Connected to One Side Only of Exhaust Fan, mm
25	125	125
50	150	150
Column 1	2	3

Note to Table 9.32.3.5.:
[1] Where flexible duct is used, the duct diameter is to be increased by 25 mm.

Supplemental Exhaust Control

The supplemental exhaust fan is to be controlled by a manual switch located in the same room as the exhaust inlet as per Article 9.32.3.5.

A supplemental exhaust fan may be controlled by a dehumidistat or other automatic control device where the required manual switch is capable of activating the fan regardless of the setting of the automatic control.

Alternate Provision

The supplemental exhaust may be provided by means of a heat recovery ventilator installed in accordance with Part 9 OBC.

EXAMPLE QUESTION

- A *dwelling unit* has 3 bedrooms and a minimum total ventilation capacity requirement of 80 L/s. What is the minimum required supplemental exhaust capacity in L/s?
    - a) 37.5
    - b) 50.0
    - c) 30.0
    - d) Part 6 design

OBC Reference ______________________________

EXERCISE #17-4

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. Which one of the following rooms does NOT require an exhaust air intake?
    - a) kitchen
    - b) main floor powder room
    - c) laundry
    - d) bathroom

OBC Reference ______________________________

2. *Exhaust ducts* serving the required kitchen, bathroom, water closet room and other supplemental exhaust air inlets are to be sized according to Part 6 OBC except that they may be sized according to Table 9.32.3.5., provided?
   a) the total duct length does not exceed 10 m
   b) the number of elbows does exceed 4
   c) where flexible duct is used the diameter is decreased by 25 mm
   d) size is not be smaller than recommended by the manufacturers of the fans.

OBC Reference ______________________________

3. What is the minimum *exhaust duct* size diameter (in mm) for a fan capacity of 25 L/s connected to flexible ducts?
   a) 125
   b) 175
   c) 150
   d) 100

OBC Reference ______________________________

4. Which of the following control switches are required where supplemental exhaust is provided by an HRV?
   a) Manual switch for HRV only.
   b) Manual switch for supplemental exhaust only
   c) Automatic controls for HRV only
   d) Manual switches for HRV and each supplemental exhaust fan

OBC Reference ______________________________

5. Which one of the following arrangements is a requirement of the OBC regarding a manual switch for a supplemental exhaust fan?
    a) manual switch located in the room it serves, and is capable of activating the fan regardless of the state of the automatic control.
    b) maintains humidity to +/- 10%
    c) 100% capacity control is available.
    d) automatic shut-off with timer

OBC Reference ______________________________

STOP

VENTILATION SYSTEM COUPLED WITH FORCED AIR HEATING SYSTEMS

As per Article 9.32.3.6., requirements for a mechanical ventilation system in a *dwelling unit* that contains a forced air heating system that is used for delivery of ventilation air are,

- In a Type I *dwelling unit*, a ventilation supply inlet is not required.
- In a Type II *dwelling unit*, the mechanical ventilation system is to include a heat recovery ventilator, coupled to the forced air heating system, installed in accordance with Part 9 OBC.

The forced air heating system circulation fan is to be controlled by a manual switch (identified by the words CIRCULATION FAN) located adjacent to the principal exhaust ventilation fan switch identified with the words VENTILATION FAN.

VENTILATION SYSTEM NOT COUPLED WITH FORCED AIR HEATING SYSTEMS

As required by Article 9.32.3.7., a mechanical ventilation system in a *dwelling unit* that does not contain a forced air heating system, or contains a forced air heating system that is not used for circulation of the ventilation air, is to include a heat recovery ventilator installed in accordance with Part 9 OBC.

Main Duct

Outdoor air is required by Article 9.32.3.7. to be distributed by a ductwork system from the heat recovery ventilator to each bedroom, to any *storey* without a bedroom and, if there is no *storey* without a bedroom, to the principal living area.

A *supply duct* from the outdoors to the heat recovery ventilator and a main distribution trunk duct is to be provided and be sized according to Part 6 OBC, except that, the *supply duct* and the main distribution trunk duct may be sized according to Table 9.32.3.7.A. The table may be used where the total duct length from the outdoor hood to any supply register does not exceed 21 m, and the total number of fittings does not exceed 8.

Table 9.32.3.7.A. Minimum Outdoor Air Supply and Main Trunk Duct Sizes
Forming Part of Sentence 9.32.3.7.(5)
TABLE 17-6

Number of Bedrooms in *Dwelling Unit*	Minimum Outdoor Air Supply And Main Distribution Trunk Duct Diameter, mm
1	150
2	150
3	175
4	175
More than 4	Part 6 design
Column 1	2

The outside air *supply duct* required above must not be considered to provide combustion and/or dilution air to fuel-burning *appliances*.

Branch Duct

Article 9.32.3.7. requires branch *supply ducts* leading from the main distribution trunk duct to the rooms to which outdoor air is to be distributed are to be provided and sized according to Part 6 OBC, except that the branch *supply* *ducts* may be sized according to Table 9.32.3.7.B where

- the total duct length from outdoor hood to supply register does not exceed 21 m, and
- the total number of fittings does not exceed 8.

Table 9.32.3.7.B. Minimum Branch Supply Duct Sizes
Forming Part of Sentence 9.32.3.7.(7)

TABLE 17-7

Room, Space Or *Storey* Served	Minimum Branch *Supply Duct* Diameter	
	1 and 2 Bedroom *Dwelling Units*, mm	3 and 4 Bedroom *Dwelling Units*, mm
Master bedroom	100	100
Other bedrooms	75	75
Storey with no bedrooms or living area	75	100
Column 1	2	3

Where the *dwelling unit* has more than 4 bedrooms, ducting is to be sized according to Part 6 OBC.

All branch *supply ducts* which are not fitted with diffusers with adjustable balance stops are to be supplied with accessible dampers which can be adjusted and fixed in their adjusted positions and which include devices to indicate the positions of the dampers.

Provision for Air Circulation Path

Provision is to be made for the free flow of air to all rooms by leaving gaps beneath doors, using louvred doors or installing grilles in doors as per Article 9.32.3.7.

EXAMPLE QUESTION

- For a Type I *dwelling unit*, which one of the following is NOT a requirement for a mechanical ventilation system in a *dwelling unit* that contains a forced air heating system that is used for delivery of ventilation air?
  - a) circulation fan is to be controlled by a manual switch (identified by the words CIRCULATION FAN)
  - b) ventilation supply inlet is not required
  - c) Manual circulation switch to be located adjacent to switch for VENTILATION FAN
  - d) heat recovery ventilator required

OBC Reference ______________________________

EXERCISE #17-5

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. A mechanical ventilation system in a *dwelling unit* that does not contain a forced air heating system, or contains a forced air heating system that is not used for circulation of the ventilation air, is to include a heat recovery ventilator installed in accordance with part 9 OBC. Which space or room does NOT require outdoor air to be distributed by a ductwork system from the heat recovery ventilator?
   - a) to each bedroom
   - b) to the laundry room
   - c) to principal living *storey* having no bedroom
   - d) to any *storey* without a bedroom

OBC Reference ______________________________

2. A *supply duct* from the outdoors to the heat recovery ventilator and a main distribution trunk duct is to be provided and be sized according to Part 6 OBC, except that, the *supply duct* and the main distribution trunk duct may be sized according to Table 9.32.3.7.A. Where a Part 9 OBC design is used, what is the minimum outdoor air supply and main distribution trunk duct diameter (in mm) for a *dwelling unit* with 3 bedrooms?
   - a) 125
   - b) 175
   - c) 150
   - d) Part 6 design

OBC Reference ______________________________

3. Branch *supply ducts* leading from the main distribution trunk duct to the rooms to which outdoor air is to be distributed are to be provided and sized according to Part 6 OBC, except that the branch *supply ducts* may be sized according to Table 9.32.3.7.B. Where a Part 9 OBC design is used, which one of the following arrangements is a requirement of the OBC regarding branch *supply ducts*?
   - a) the total duct length from outdoor hood to supply register does not exceed 21 m
   - b) the total number of diffusers does not exceed 8
   - c) the total duct length from the main duct to supply register does not exceed 21 m
   - d) the total number of fittings exceeds 8.

OBC Reference ______________________________

4. Which one of the following is NOT a suggested method or arrangement for the provision of the free flow of air to all rooms?
    a) leaving gaps beneath doors
    b) using louvered doors
    c) provide removable door stops to keep doors ajar
    d) Installing grilles in doors

OBC Reference ______________________________

STOP

PROTECTION AGAINST DEPRESSURIZATION

When determining the need to provide protection against depressurization, Article 9.32.3.8. requires that consideration must be given to

- whether the presence of soil gas is deemed to be a problem, and
- the presence of solid fuel-fired combustion *appliances*.

Where a solid fuel-fired combustion *appliance* is installed, the ventilation system is to include a heat recovery ventilator which is designed to operate so that the flow of exhaust air does not exceed the flow of intake air in any operating mode, and which complies with Part 9 OBC.

Fan Ratings: As per Article 9.32.3.9., mechanical ventilation devices are to conform to CSA-C22.2 No. 113, "Fans and Ventilators".

Capacity ratings for required fans are to be based on a static pressure differential depending on ductwork connected as

- 50 Pa – duct on both sides,
- 25 Pa – duct on one side, or
- 7.5 Pa – duct on neither side.

Capacity and sound ratings for required fans (including heat recovery ventilators) are to be determined in accordance with CAN/CSA-C260, "Rating the Performance of Residential Mechanical Ventilating Equipment", or HVI 915, "Procedure for Loudness Rating of Residential Fan Products".

Exhaust fans, except for heat recovery ventilators, that are required to make up any part of the total ventilation capacity are to have a sound rating not greater than that specified in Table 9.32.3.9.. Since the sound rating requirements apply only to those fans which are provided to meet the required total ventilation capacity, kitchen fans that do not contribute to the total capacity are not required to have a sound rating. However, in cases where the kitchen fan contributes to the total required ventilation capacity, these fans are required to have the fan sound rating.

Table 9.32.3.9. Fan Sound Rating
Forming Part of Sentence 9.32.3.9.(4)

TABLE 17-8

Fan Application	Maximum Sound Ratings, sones	
	Rated according to CAN/CSA-C260-M	Rated according to HVI 915
Principal exhaust fan	2	2.5
Supplemental exhaust fans installed in bathrooms and water closet rooms and their make-up air fans	2.5	3.5
Supplemental exhaust fans installed in kitchens and their make-up air fans	no rating required	no rating required
Column 1	2	3

Required fans are to be installed according to the manufacturer's instructions.

MECHANICAL VENTILATION DUCTS

As required by Article 9.32.3.10., ventilation ducts are to conform to the requirements of Part 6 OBC for *supply ducts* except that *exhaust ducts* that serve only a bathroom or water closet room may be of *combustible* material provided the duct is reasonably airtight and constructed of a material impervious to water.

Exhaust ducts must not discharge into heated or unheated enclosed spaces.

Insulation of Ducts

Where an *exhaust duct* passes through or is adjacent to unheated space, the duct is to be insulated to not less than RSI 0.5 as per Article 9.32.3.10.

Where a *supply duct* carrying outdoor air that is not heated or not mixed with indoor air, passes through heated space, it is to be insulated to not less than RSI 0.5. Where such a duct is exposed in the heated space for more than 3 m of length, it must be insulated to not less than the values listed in Table 9.32.3.10.A.

Table 9.32.3.10.A Insulation of Fresh Air Supply Ducts

Forming Part of Sentence 9.32.3.10.(4)

TABLE 17-9

Outside Winter Design Temperature as per Supplementary Standard SB-1[1], °C	Minimum Thermal Resistance, RSI
-7 to –11	0.5
-12 to –17	0.9
-18 to –24	1.2
-25 to –29	1.4
-30 to –34	1.8
-35 and colder	2.1
Column 1	2

Note to Table 9.32.3.10.A:

[1] The outside winter design temperatures are to be those listed for the January 2.5 percent values.

Kitchen Duct Arrangement and Accessories

Article 9.32.3.10. requires a kitchen *exhaust duct* not equipped with a filter at the inlet end is to be designed and installed so that the entire duct can be cleaned.

Ductwork for range hoods and range-top fans are to be equipped with a grease filter at the intake.

Ductwork for range hoods and range-top fans is to be of *noncombustible*, corrosion-resistant material and is to lead directly to the outdoors without connection to other exhaust fans or ducts.

Duct Support and Sealing

All ductwork is to be permanently supported or clipped to prevent sagging, excessive movement and vibration in accordance with Article 9.32.3.10.

All ducting connected to supply and exhaust fans is to be constructed so as to inhibit air leakage at joints.

Rectangular Duct

As required by Article 9.32.3.10., where rectangular duct is used in place of round duct, it is to be selected according to Table 9.32.3.10.B.

Table 9.32.3.10.B **Equivalent Duct Sizes**
Forming Part of Sentence 9.32.3.10.(10)

TABLE 17-10

Required Round Duct Size, mm	Permitted Equivalent Rectangular Duct Size, mm			
	Stack Duct	100 mm Depth	125 mm Depth	150 mm Depth
75	82 x 250	57 x 100		
100	82 x 250	89 x 100	75 x 125	75 x 150
125	82 x 250	125 x 100	100 x 125	89 x 150
150	82 x 300	200 x 100	150 x 125	125 x 150
175	82 x 350	275 x 100	200 x 125	175 x 150
More Than 175	Part 6 Design	Part 6 Design	Part 6 Design	Part 6 Design
Column 1	2	3	4	5

STOP

EXAMPLE QUESTION

- Which one of the following operational situations is to be avoided, regarding depressurization?
  a) flow of intake air does not exceed the flow of exhaust air
  b) flow of exhaust air equals the flow of intake air
  c) flow of exhaust air does not exceed the flow of intake air
  d) presence of soil gas mechanical dissipation system

OBC Reference ______________________________

EXERCISE #17-6

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple choice method.

1. Mechanical ventilation devices are to conform to CSA-C22.2 No. 113, "Fans and Ventilators". At what static pressure differential (in Pa) are fan capacity ratings determined for fans with duct connected on one side?
   a) 7.5
   b) 12
   c) 25
   d) 50

OBC Reference ______________________________

2. Which one of the following discharge arrangements does NOT conform to the OBC, regarding the discharge of *exhaust ducts*?
   a) into a heat recovery ventilator
   b) into an exterior wall exhaust discharge vent
   c) into an attic space
   d) into an exterior roof exhaust discharge vent

OBC Reference ______________________________

3. A single-family house in Bradford, Ontario contains a *supply duct* carrying outdoor-unheated air passing through 3 m of heated space and requires insulation. What is the minimum RSI value of insulation required?
   a) 0.5
   b) 1.2
   c) 1.4
   d) 4 400

OBC Reference ______________________________

4. Which one of the following rectangular duct sizes (in mm) is NOT permitted as an equivalent for a round duct size of diameter 100 mm?
   a) 75 x 125
   b) 75 x 150
   c) 89 x 89
   d) 89 x 100

OBC Reference ______________________________

STOP

HEAT RECOVERY VENTILATORS

As per Article 9.32.3.11., heat recovery ventilators are to be designed to provide a minimum 55% sensible heat recovery efficiency when tested to the low temperature thermal and ventilation performance test method set out in CAN/CSA-439, "Rating the Performance of Heat/Energy Recovery Ventilators". Station 1 test temperature to be −25°C at an air flow not less than 30 L/s.

Connections Requirements

Where a heat recovery ventilator is connected to a forced air heating system, the supply side of the ventilator is required by Article 9.32.3.11. to be directly connected to the return air side of the forced air heating system.

Two or more heat recovery ventilators must not be connected in parallel air flow to a common air *supply duct* unless specifically recommended by the manufacturer.

Two or more heat recovery ventilators must not be connected in parallel air flow to a common downstream *exhaust duct*.

Condensate Control

Article 9.32.3.11. requires free flow of condensate is to be provided in accordance with the manufacturer's recommendations or, in their absence, a condensate drain of minimum 1/2 inch nominal pipe size pitched in the direction of flow and complete with a trap or condensate pump with sufficient capacity is to be installed.

Heat recovery ventilators installed in unheated spaces are to be installed so as to avoid condensation of moisture on fans and motors in exhaust air, in accordance with the manufacturer's instructions.

The heat recovery ventilator and all condensate lines are to be installed in a space where the ambient temperature will not adversely affect the operation of the system.

Start-up and Operation

All start-up procedures recommended by the manufacturer including air balancing and air flow determination are to be followed as per Article 9.32.3.11.

When operating at required capacity the supply and exhaust airflow rates of the heat recovery ventilator are to be balanced so that the value of the lesser flow is to be at least 90% of the value of the greater flow, unless otherwise recommended by the manufacturer.

Outdoor Intake and Exhaust Openings

Separate air intake and exhaust outlet openings, when located on the same wall or roof, are required by Article 9.32.3.12. to be installed so as to avoid contamination of the ventilation air by the exhaust air.

Intake openings are to be located so as to avoid contamination of the ventilation air from other local sources such as automobile exhausts and exhaust from adjacent *buildings*.

Air intakes are to be clearly labeled as such for identification from locations outside the *dwelling unit*.

Clearances

As required by Article 9.32.3.12., the distance from the bottom of an air intake opening to finished ground level or to any nearer and lower permanent horizontal surface must be not less than 450 mm or the depth of expected snow accumulation, whichever is greater.

The distance from the bottom of an exhaust outlet to finished ground level or to any nearer and lower permanent horizontal surface must be not less than 100 mm.

The distance separating air intakes from *building* envelope penetrations that are potential sources of contaminants, such as *gas vents* or oil fill pipes, must be not less than 900 mm.

Opening Protection and Backdraft Prevention

Where air intake and exhaust openings are in exposed locations, provision are to be made to protect them from the entry of precipitation by the use of louvres, weather cowls or other suitable protection as per Article 9.32.3.12.

Air intake openings are to incorporate screens or grilles to protect against the entry of animals and insects.

Except for exhaust outlets serving heat recovery ventilators, exhaust outlets are to incorporate backdraft dampers.

Where a screen or grille is required and has a mesh size of less than 6 mm, the screen or grille is to be removable for cleaning.

The gross area of the screens or grilles installed in intake and exhaust openings are to be three times that of the duct served.

The net free area of an air intake or exhaust outlet is to be equal to or greater than the cross-sectional area of the duct served.

Screens and grilles are to be of corrosion-resistant material.

Ventilation Equipment Installation

Installation of fans and heat recovery ventilators are required by Article 9.32.3.13. to be in accordance with manufacturer's instructions for minimizing noise and vibration transmission and achieving the required sound rating.

Where flow-regulating dampers are required, they are to be adjustable and accessible without requiring the removal of fans, motors, or insulating materials and without the need for specialized tools.

Ventilation equipment is to be accessible for inspection, maintenance, repair and cleaning.

Ventilation equipment installed in unheated spaces is to be installed so as to avoid condensation of moisture on fans and motors in accordance with the manufacturer's instructions.

STOP

EXAMPLE QUESTION

- A heat recovery ventilator is connected to a forced air heating system. Which one of the following connections is permitted by the OBC?
    - a) supply side of the forced air heating system
    - b) in parallel air flow to the common downstream *exhaust duct*
    - c) to the laundry equipment exhaust
    - d) return side of the forced air heating system

OBC Reference ______________________________

EXERCISE #17-7

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. Heat recovery ventilators and all condensate lines are to be installed in spaces where ambient conditions will not adversely affect the operation of the system. Which one of the following ambient conditions is of most concern?
    a) humidity
    b) elevated temperatures
    c) dust, dirt and mould
    d) freezing temperatures

OBC Reference ______________________________

2. The distance separating air intakes from *building* envelope penetrations that are potential sources of contaminants, such as *gas vents* or oil fill pipes, must be not less than what value (in mm)?
    a) 100
    b) 450
    c) 900
    d) Good engineering practice

OBC Reference ______________________________

3. The gross area of the screens or grilles installed in intake and exhaust openings is to what ratio of the area of duct served?
    a) equal
    b) 0.3
    c) 3.0
    d) 30

OBC Reference ______________________________

4. Which of the following is a requirement of the OBC with regard to required flow-regulating dampers?
   - a) removal of fans and motors
   - b) adjustable and accessible
   - c) specialized tools
   - d) removal of insulation

OBC Reference ______________________________

STOP

HEATING AND AIR-CONDITIONING

Design and Installation Requirements

As per Article 9.33.1.1., the design and installation of central heating systems including requirements for combustion air, are to conform to the requirements in both Part 6 OBC and to Section 9.33. Heating and Air-Conditioning.

The design and installation of *air-conditioning* systems are to conform to Part 6 OBC only.

Repairs, adjustments or component replacements that change the capacity or extent of safety of an existing heating, ventilating or *air-conditioning* system and that alter the method of operation are to conform to the OBC.

Solid Fuel-Burning Appliances

The design and installation of solid-fuel burning *stoves*, *ranges* and *space heaters*, including the requirements for combustion air, are to conform to CAN/CSA-B365-M, "Installation Code for Solid-Fuel Burning Appliances and Equipment" as per Article 9.33.1.2.

Required Heating Systems – Residential

Residential *buildings* intended for use in the winter months on a continuing basis are required by Article 9.33.2.1. to be equipped with heating facilities conforming to Section 9.33 Heating and Air-Conditioning.

Indoor Design Temperatures

In accordance with Article 9.33.3.1., at the outside design temperature, required heating facilities are to be capable of maintaining an indoor air temperature of not less than

- 22°C in all living spaces,
- 22°C in unfinished *basements*, and
- 15°C in heated crawl spaces.

The OBC provides exclusions for *buildings* (9.36.2.1.) used or intended to be used as seasonal recreational *buildings*, in particular to this module, heating and/or air-conditioning systems need not be provided. However, where heating and/or air-conditioning systems are provided in the *building*, they are to comply with the full requirements of Part 9 OBC (further exception for heating and/or air-conditioning systems, where provided, the requirements of 9.33.3.1. Indoor Design Temperatures need not be complied with).

Outdoor Design Temperatures

As per Article 9.33.3.2., the outdoor conditions to be used in designing heating, ventilating and *air-conditioning* systems are to be the appropriate values for the Municipality as set out in Supplementary Standard SB-1, Table 1.2, using 2.5 per cent design temperature criteria.

By entering the table at the location of, or nearest to, the *building* location, design temperatures and other location specific information is determined.

STOP

EXAMPLE QUESTION

- Which one of the following HVAC system characteristics, when altered by repair, adjustment, or component replacement, does NOT constitute an alteration that requires conformance to the OBC?
  a) Method of operation
  b) Energy efficiency
  c) Extent of safety
  d) System capacity

OBC Reference ______________________

EXERCISE #17-8

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. A summer cottage is used occasionally for winter activities. A small heater is installed to provide minimal heat in the winter months. What minimum indoor air temperature for living spaces is required by the OBC?
   a) 22 °C
   b) 55 °F
   c) 15 °C
   d) No minimum temperature required

OBC Reference ______________________

2. What is the outdoor design temperature value for Cobourg Ontario?
   a) –21 °C
   b) –23 °C
   c) –25 °C
   d) 22 °C in all living spaces

OBC Reference ______________________

3. Which one of the following solid-fuel burning devices does NOT required conformance to the CAN/CSA-B365-M, "Installation Code for Solid-Fuel Burning Appliances and Equipment"?

   a) *range*
   b) masonry fireplace
   c) *stove*
   d) *space heater*

OBC Reference ______________________________

4. What is the heating degree day value for Campbellford, Ontario?

   a) 4550
   b) 4150
   c) 4450
   d) 850

OBC Reference ______________________________

STOP

CARBON MONOXIDE DETECTORS

As per Article 9.33.4.1., the OBC requirements for carbon monoxide detectors apply to every *building* that contains a *residential occupancy* and contains a fuel-burning *appliance* or a *storage garage*.

Location of Carbon Monoxide Detectors

Where a fuel-burning *appliance* is installed in a *suite* of *residential occupancy*, a carbon monoxide detector is required by Article 9.33.4.2. to be installed adjacent to each sleeping area in the *suite*.

Where a fuel-burning *appliance* is installed in a *service room* that is not in a *suite* of *residential occupancy*, a carbon monoxide detector is to be installed

- adjacent to each sleeping area in every *suite* of *residential occupancy* that is adjacent to the *service room*, and
- in the *service room*.

Where a *storage garage* is located in a building containing a *residential occupancy*, a carbon monoxide detector is to be installed adjacent to each sleeping area in every *suite* of *residential occupancy* that is adjacent to the *storage garage* as per Article 9.33.4.2.

Where a *storage garage* serves only the *dwelling unit* to which it is attached or built in, a carbon monoxide detector is to be installed adjacent to each sleeping area in the *dwelling unit*.

Installation and Conformance to Standards

As per Article 9.33.4.3., the required carbon monoxide detector is to be

- permanently connected to an electrical circuit and must have no disconnect switch between the overcurrent device and the carbon monoxide detector,
- be wired so that its activation will activate all carbon monoxide detectors within the *suite*, where located within a *suite* of *residential occupancy*,
- be equipped with an alarm that is audible within bedrooms when the intervening doors are closed, where located adjacent to a sleeping area.

The required carbon monoxide detector is to conform to

CAN/CSA 6.19, "Residential Carbon Monoxide Alarming Devices", or

- UL 2034, "Single and Multiple Station Carbon Monoxide Detectors".

STOP

EXAMPLE QUESTION

- Where a fuel-burning *appliance* is installed in a *service room* that is not in a *suite* of *residential occupancy*, a carbon monoxide detector is to be installed in which locations?
  - a) Adjacent to each sleeping area in the *suite*
  - b) Adjacent to the service room
  - c) Adjacent to each sleeping area in the *suite* and in the service room
  - d) In each sleeping area and in the service room

OBC Reference ______________________________

EXERCISE #17-9

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. In the supply line electrical circuit for a carbon monoxide detector, which two devices are permanently connected without a facility for disconnection?
   - a) Overcurrent device and disconnect switch
   - b) Disconnect switch and carbon monoxide detector
   - c) Overcurrent device and carbon monoxide detector
   - d) Carbon monoxide detector and audible alarm

OBC Reference ______________________________

2. Where a *storage garage* is located in a single *dwelling unit*, where are carbon monoxide detectors to be located?
   a) In each sleeping area
   b) Adjacent to every *suite* and in the *storage garage*
   c) Adjacent to each sleeping area in the *dwelling unit*.
   d) In *storage garage* only.

OBC Reference ______________________________

3. Where there are multiple carbon monoxide detectors are located within a *suite* of *residential occupancy*, which of the following arrangements is required to conform to the OBC?
   a) Wired with a common disconnect switch
   b) Wired so the activation of one will activate all
   c) Wired to a single audible alarm point
   d) Wired so the activation of one will activate the carbon monoxide detector in the garage

OBC Reference ______________________________

4. The OBC requirements for carbon monoxide detectors apply to a *building* that contains?
   a) a *residential occupancy* containing an electric stove
   b) an *assembly occupancy* and containing a *storage garage*
   c) a *repair garage* adjacent to *personal services occupancy*
   d) a *residential occupancy* containing a fuel-burning *appliance*

OBC Reference ______________________________

STOP

Ontario Ministry of Municipal Affairs and Housing

BUILDING SERVICES

PARTICIPANT'S MODULE #18

Renovations

JAN06

INTRODUCTION

This module examines the requirements and options available to OBC compliance for alterations or extensions to existing *buildings* and *building systems* and the concept of a *compliance alternative*. Consistent with the scope of this course, focus will be maintained on subject matter regarding Building Services, covered in Part 3, 6, and 9.

OBJECTIVES

Upon completion of this module participants will be able to:

- Communicate the applicability of Part 11 to Building Services;
- Summarize Part 11 terminology;
- Know and understand the allowable *compliance alternatives* to Parts 3, 6, and 9;
- Use selection criteria for application of Compliance Alternatives.

STOP

DEFINITIONS

As described in Article 11.1.1.2., *building system* means a combination of elements or components that form a complete major division of *construction* in the design of a *building* or part of a *building*:

- a structural or framing system,
- a waterproofing system,
- a *drainage system*,
- an exterior cladding system,
- a roofing system,
- a window system,
- a partition system,
- a corridor system,
- a stair system,
- a fire alarm and detection system,
- a sprinkler system,
- a heating, ventilation or *air conditioning* system,
- a *foundation* system,

- a standpipe and hose system,
- a flooring system,
- a *plumbing system*,
- a *sewage system*
- or an electrical system.

Compliance alternative means a substitute for a requirement in another Part of the Code that is listed in Part 10 or 11, and "C.A." has a corresponding meaning.

NEW AND EXISTING BUILDING SYSTEMS

Material Alteration or Repair of a Building System

As per Article 11.3.1.1., where an existing *building system* is materially altered or repaired, the *performance level* of the *building* after the material alteration or repair is to be at least equal to the *performance level* of the *building* prior to the material alteration or repair.

NEW BUILDING SYSTEMS AND EXTENSION OF EXISTING BUILDING SYSTEMS – APPLICATION OF PART 11 OBC

Article 11.3.1.2. addresses the design and *construction* of a new *building system* or the extension of an existing *building system*, and requires that they are to comply with all other Parts of the OBC. Exceptions are as described in Basic Renovation and Compliance Alternatives and Alternative Measures to follow.

Where an existing *building* is extended, Article 11.3.2.1. mandates that Part 11 OBC apply to the existing portion of the *building* and the extended portion of the *building* must comply with all other Parts of the OBC.

Basic Renovation

Construction may be carried out to maintain the existing *performance level* of all or part of an existing *building*, by the reuse, relocation or extension of the same or similar materials or components, to

- retain the existing character,

- structural uniqueness,

- heritage value,
- or aesthetic appearance of all or part of the *building*

if the *construction* will not adversely affect the early warning and evacuation systems, fire separations, the structural adequacy or create an unhealthy environment in the *building*.

However, *construction* in respect of a *hotel* may only be carried out in accordance with the above sentence provided that the *construction* will be in conformance with Part 9 of the Ontario Fire Code made under the *Fire Marshals Act*.

Extensive Renovation

Extensive renovation is where existing interior walls or ceilings or floor assemblies or roof assemblies are substantially removed in an existing *building* and new interior walls, ceilings, or floor assemblies are installed in the *building*. Structural and fire-resistance elements are then to be constructed in compliance with the requirements of the other Parts of the Code.

Compliance Alternatives

A *compliance alternative* shown in Tables 11.5.1.1.A., 11.5.1.1.B., 11.5.1.1.C., 11.5.1.1.D/E. or 11.5.1.1.F. may be substituted for a requirement contained in Part 3, 4, 5, 6, 7 or 8 OBC where the *chief building official* is satisfied that compliance with the requirement is impracticable because

- of structural or *construction* difficulties, or
- it is detrimental to the preservation of a *heritage building*.

A *compliance alternative* shown in Tables 11.5.1.1.A., 11.5.1.1.B., 11.5.1.1.C., 11.5.1.1.D/E. or 11.5.1.1.F. may be substituted for a requirement contained in Part 9 OBC without satisfying the *chief building official* that compliance with the requirement is impracticable.

EXAMPLE QUESTION

- Where an existing *building system* is materially altered or repaired, which one of the following best describes OBC requirements for the work?
  - a) Resulting *performance level* must conform to all Parts of the OBC
  - b) Resulting *performance level* must be greater than prior to alteration or repair
  - c) Resulting *performance level* is to be at least equal to the level prior to the work
  - d) Resulting *performance level* must be more thermally efficient than prior to work

OBC Reference ______________________________

EXERCISE #18-1

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. Which one of the following building types has a further Fire Code requirement beyond the OBC requirements governing a Basic Renovation?
   - a) *Hotel*
   - b) *dwelling unit*
   - c) *building* containing *personal services suites*
   - d) all *building* types

OBC Reference ______________________________

2. Where can *compliance alternatives* be found in the OBC?
   a) In the OBC Part where the initial requirement is stated
   b) In Part 7
   c) Listed in Part 10 and 11
   d) Listed in Part 12

OBC Reference ______________________________

3. The design and *construction* of a new *building system* or the extension of an existing *building system*, is to comply with which one of the following?
   a) all other Parts of the OBC only
   b) OBC Part 11 for existing, all other Parts for new
   c) all other Parts of the OBC except for Basic Renovations, C.A.'s, and Alternative Measures
   d) OBC Part 11 only

OBC Reference ______________________________

STOP

COMPLIANCE ALTERNATIVES A4, A8, A18, A20 – A24, A31, A32, A42, A55, A57, A62, A63, B3, B7, B15, B19, B23 – B27, B44, B61, B65

Compliance alternatives are categorized into separate tables according to their application to a specific occupancy. For example **A62** is the 62nd *compliance alternative* for *assembly occupancies*. Since this course deals with *building* services spanning several different occupancy groups the *compliance alternatives* examined in this course cover Tables 11.5.1.1.A., 11.5.1.1.B., 11.5.1.1.C., 11.5.1.1.D/E., and 11.5.1.1.F.

Selecting A62 as an example for *compliance alternative;* reference Article **3.6.3.4 Exhaust Duct Negative Pressure,** of **Section 3.6 Service Facilities.** The Part 3 requirement is as follows:

- - - - - - - - - - - - - - - - *start of OBC text* - - - - - - - - - - - - - - - -

3.6.3.4. Exhaust Duct Negative Pressure

(1) If a *vertical service space* contains an exhaust duct that serves more than one *fire compartment*, the duct shall have a fan located at or near the exhaust outlet to ensure that the duct is under negative pressure.

- - - - - - - - - - - - - - - - *end of OBC text* - - - - - - - - - - - - - - - -

Article 3.6.3.4. sets out the OBC requirements for maintaining negative pressure in exhaust ducts. In the case of an existing *building* of *assembly occupancy* with proposed alterations to *building systems* the *compliance alternative* A62 revises the Part 3 requirement as worded

- - - - - - - - - - - - - - - - *start of OBC text* - - - - - - - - - - - - - - - -

A62 – Existing acceptable.

- - - - - - - - - - - - - - - - *end of OBC text* - - - - - - - - - - - - - - - -

This *compliance alternative* takes into account the functionality of the existing exhaust fan and duct arrangement and recognizes that it may be impractical to alter the exhaust fan arrangement in an existing *assembly occupancy*.

Note that there are no *compliance alternatives* regarding Article 3.6.3.4 for other *occupancies* described in Tables 11.5.1.1.B., 11.5.1.1.C., 11.5.1.1.D/E., and 11.5.1.1.F. correspondingly. As we examine *compliance alternatives* further similar and identical will be seen to cover some or all of the different *occupancies*.

The following portions of Table 11.5.1.1.A. and Table 11.5.1.1.B contain some of the *compliance alternatives* directly related to the scope of the Building Services course.

Table 11.5.1.1.A.
Compliance Alternatives for Assembly Occupancies
Forming Part of Article 11.5.1.1.

TABLE 18-1

NUMBER	PART 3 REQUIREMENTS	PART 11 COMPLIANCE ALTERNATIVE
A4	3.1.5.15.; 3.1.5.16. 3.1.5.17.; 3.1.5.21.; 3.1.5.23.	Existing acceptable.
A8	3.1.8.7.; 3.1.8.8.; 3.1.8.9.	*Fire dampers* or *fire stop flaps* are not required to be installed in existing ducts at penetrations of existing *fire separations*.
A18	3.2.4.	(a) Existing fire alarm system may remain except that Article 3.2.4.5. does not apply where the "Fire Safety Plan" (as described in Subsection 2.8.2. of the Ontario Fire Code) for the *building* addresses the intent of Subsection 3.2.4. (i.e., "stage" system, electrical supervision, detection as required, Fire Department connection and emergency power supply), and (b) extension of an existing system must ensure continuity and compatibility, and integrity of the system.
A20	3.2.5.5.; 3.2.5.6.;3.2.5.4.	Existing acceptable provided the building is sprinklered.
A21	3.2.5.7.	Does not apply, except where a change in *major occupancy* occurs from a lesser *hazard index*.
A22	3.2.5.13.	Existing sprinkler systems in existing *buildings* that do not conform to NFPA 13 may be altered, added to, or extended from the existing system without complying with NFPA 13, provided the system is operational and adequate with respect to coverage, water supply and controls, and provided the system is evaluated by a qualified designer.
A23	3.2.6.	Reserved
A24	3.2.9.	(a) Does not apply to *buildings* 6 *storeys* and less. (b) Does not apply to *sprinklered buildings*.
A31	3.3.2.12.	Reserved
A32	3.3.5.4.(1); 3.3.5.7.(1) to (3)	Need not comply where a gasketed door and self closer are provided in the existing *fire separation*.
A42	3.4.5.1.(2) and (7)	Existing illuminated legible *exit* signs are acceptable.
A55	3.6.2.2.	Existing acceptable where explosion-resistant *construction* or venting is provided.
A57	3.6.2.8.(1)	2 h *fire separation* acceptable.
A62	3.6.3.4.	Existing acceptable.
A63	3.6.4.	Existing acceptable.

Table 11.5.1.1.B.
Compliance Alternatives for Care or Detention Occupancies
Forming Part of Article 11.5.1.1.

TABLE 18-2

NUMBER	PART 3 - REQUIREMENTS	PART 11 - COMPLIANCE ALTERNATIVE
B3	3.1.5.15.; 3.1.5.16.; 3.1.5.17.; 3.1.5.21.; 3.1.5.23.	Existing acceptable.
B7	3.1.8.7.; 3.1.8.8.; 3.1.8.9.	*Fire dampers* or *fire stop flaps* are not required to be installed in existing ducts at penetrations of existing *fire separations*.
B15	3.1.9.5.(1) and (2)	Existing openings in existing ceiling membranes to remain. Existing openings may be moved to another location in the same ceiling provided the aggregate area of openings does not increase and are not cumulative, and the existing opening is blocked up to provide the same rating as the ceiling assembly.
B19	3.2.4.	(a) Existing fire alarm system may remain except that Article 3.2.4.5. does not apply where the "Fire Safety Plan" (as described in Subsection 2.8.2. of the Ontario Fire Code) for the *building* addresses the intent of Subsection 3.2.4. (i.e. "stage" system, electrical supervision, detection as required, Fire Department connection, and emergency power supply), and (b) extension of an existing system must ensure continuity and compatibility, and integrity of the system.
B23	3.2.5.4.; 3.2.5.5.; 3.2.5.6.	Existing access route to existing *occupancy* is acceptable if the *building* is *sprinklered*. Where existing *building* is changed to a "B" *occupancy*, access route shall be provided.
B24	3.2.5.7.; 3.2.5.18.	Does not apply except where a change in *occupancy* occurs to a "B1" or "B2" *occupancy*, where occupants are not normally evacuated from the *building*.
B25	3.2.5.13.	Existing sprinkler systems in existing *buildings* that do not conform to NFPA 13 may be altered, added to, or extended from the existing system without complying with NFPA 13, provided the system is operational and adequate with respect to coverage, water supply and controls, and provided the system is evaluated by a qualified *designer*.
B26	3.2.6.	Reserved
B27	3.2.9.	Does not apply except where a change in *occupancy* occurs to a Group B *occupancy*, where occupants are not normally evacuated from the *building*.
B37	3.3.3.7.	45 min *fire separation* acceptable.
B44	3.4.5.1.(2) and (7)	Existing illuminated legible *exit* signs are acceptable.
B61	3.6.2.7.(1)	2 h *fire separation* acceptable.
B65	3.6.4.	Existing acceptable, except where a change in *occupancy* occurs to a Group B *occupancy*.

STOP

EXERCISE #18-2

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. Which one of the following is acceptable as a compliance alternative with regard to service rooms under exits in assembly occupancies?
   - a) existing equipment subject to explosion is acceptable;
   - b) boilers operating at 200kpa are acceptable;
   - c) existing acceptable where explosion-resistant construction or venting is provided;
   - d) 3hr fire rating must be provided.

OBC Reference ______________________________

2. For the compliance alternative relating to an existing sprinkler system in a care occupancy, which one of the following is NOT required under Part 11 OBC?
   - a) system must have an adequate water supply
   - b) system must be pressure tested
   - c) system must be operational
   - d) system must be evaluated by a qualified designer

OBC Reference ______________________________

STOP

COMPLIANCE ALTERNATIVES C4, C7, C9, C17, C18, C22-C26, C48, C64, C66, C72, C86-C90, C92, C94, C176, C191-C194

Selecting C26 as an example for *compliance alternative*; reference Subsection **3.2.9. Standpipe Systems**, of **Section 3.2 Building Fire Safety**. The Part 3 requirement is as follows:

- - - - - - - - - - - - - - - *start of OBC text* - - - - - - - - - - - - - - - - - -

3.2.9. Standpipe Systems

3.2.9.6. Water Supply for 38 mm Hose Connections

(1) If a standpipe and hose system is required, the water supply shall be sufficient to provide a flow, measured at each of the two hydraulically most remote 38 mm diameter hose connections

(a) of not less than 380 L/min,

(b) for not less than 30 min,

(c) at a pressure of not less than 450 kPa, and

(d) of not less than 190 L/min from each of the two outlets simultaneously.

3.2.9.7. Water Supply for 65 mm Hose Connections

(1) If 65 mm diam hose connections are required, the water supply shall be sufficient to provide a flow, measured at each of the two hydraulically most remote 65 mm diam hose connections

(a) of not less than 1 890 L/min,

(b) for not less than 30 min,

(c) at a pressure of not less than 450 kPa, and

(d) of not less than 945 L/min from each of the two outlets simultaneously.

(2) If the *building* is less than 84 m high, measured between *grade* and the ceiling level of the top *storey*, the water supply required in Sentence (1) is permitted to be supplied through the fire department connection.

(3) If the *building* is 84 m or more high, measured between *grade* and the ceiling level of the top *storey*, the water supply required in Sentence (1) shall be provided by sufficient pumping capacity.

(4) If the *building* is 84 m or more high, measured between *grade* and the ceiling level of the top *storey*, the *building* shall be served by not less than two sources of water supply from a public water system.

- - - - - - - - - - - - - - *end of OBC text* - - - - - - - - - - - - - - - -

Subsection 3.2.9. sets out the OBC requirements for the installation of standpipe systems. In the case of an existing *building* of *residential occupancy* with proposed alterations to *building systems* the *compliance alternative* C26 revises the Part 3 requirement as worded

- - - - - - - - - - - - - - - *start of OBC text* - - - - - - - - - - - - - - - - -

C26 – Does not apply to *buildings* 4 *storeys* and less. For existing *buildings* over 4 *storeys* in *building height*, existing standpipe and hose systems water supply is acceptable provided it can deliver a minimum flow rate of 265 L/min for 30 min at 345 kPa (gauge) at the two highest and most remote hose valves, with not less than 132 L/min from each of the two simultaneously.

- - - - - - - - - - - - - - - - *end of OBC text* - - - - - - - - - - - - - - - -

This *compliance alternative* takes into account the functionality of the existing standpipe system equipment and revises the minimum pressure and flow rate requirements.

Note *compliance alternatives* dealing with Subsection 3.2.9. Standpipe Systems occur as A24, B27, DE24, and F26 in Tables 11.5.1.1.A., 11.5.1.1.B., 11.5.1.1.D/E., and 11.5.1.1.F. correspondingly. However, the wording of the *compliance alternatives* is not identical.

The following portion of Table 11.5.1.1.C. contains some of the *compliance alternatives* directly related to the scope of the Building Services course.

Table 11.5.1.1.C.
Compliance Alternatives for Residential Occupancies
Forming Part of Article 11.5.1.1.

TABLE 18-3

NUMBER	PART 3 - REQUIREMENTS	PART 11 - COMPLIANCE ALTERNATIVE
C4	3.1.5.14.; 3.1.5.15.; 3.1.5.16.; 3.1.5.17.; 3.1.5.21.; 3.1.5.23.	Existing acceptable.
C7	3.1.8.1.(2); 3.1.8.6.(1) and (2)	Existing functional *closures* are acceptable and may be relocated within the same existing *fire separation*.
C9	3.1.8.7.; 3.1.8.8.; 3.1.8.9.	Except for *hotels*, *fire dampers* or *fire stop flaps* are not required to be installed in existing ducts at penetrations of existing *fire separations*.
C17	3.2.4.	(a) Existing fire alarm system may remain except that Article 3.2.4.5. does not apply where the "Fire Safety Plan" (as described in Subsection 2.8.2. of the Ontario Fire Code) for the *building* addresses the intent of Subsection 3.2.4. (i.e. "stage" system, electrical supervision, detection as required, Fire Department connection, and emergency power supply), and (b) extension of an existing system must ensure continuity and compatibility, and integrity of the system.
C18	3.2.4.21.	Such *smoke alarms* may be battery operated.
C22	3.2.5.4.; 3.2.5.5.; 3.2.5.6.	(a) For *buildings 6 storeys* and less, existing access to existing *occupancy* is acceptable, and (b) Where existing *building* is changed to a "C" *occupancy*, an access route shall be provided, or the existing access is acceptable provided the *building* is *sprinklered*.
C23	3.2.5.7.	Existing water supply and hydrants are acceptable in *buildings* up to 6 *storeys* in *building height*.
C24	3.2.5.13.	Existing sprinkler systems in existing *buildings* that do not conform to NFPA 13 may be altered, added to, or extended from the existing system without complying with NFPA 13, provided the system is operational and adequate with respect to coverage, water supply and controls, and provided the system is evaluated by a qualified designer.
C25	3.2.6.	Reserved
C48	3.4.5.1.(2) and (7)	Existing illuminated legible *exit* signs are acceptable.
C64	3.6.2.2.	Existing acceptable where explosion-resistant *construction* or venting is provided.
C66	3.6.2.7.(1)	2 h *fire separation* acceptable.
C72	3.6.4.3.(1)	Existing to meet *flame-spread rating* of 25 or to be *sprinklered*.
C86	6.2.3.2.; 6.2.3.8.; 6.2.3.16.; 6.2.3.17.	Existing acceptable.

NUMBER	PART 6 - REQUIREMENTS	PART 11 - COMPLIANCE ALTERNATIVE
C87	6.2.3.9.(2)	In a *building* containing not more than four *dwelling units* or residential *suites*, the existing heating or *air conditioning* system may be altered to serve more than one *dwelling unit* or *suite* provided *smoke alarms* are installed in each *dwelling unit* or *suite* and provided a *smoke detector* is installed in the supply or return air duct system serving the entire *building* which would turn off the fuel supply and electrical power to the heating system upon activation of such detector.
C88	6.2.3.12.	Existing openings, grilles and diffusers acceptable.
C89	6.2.4.2.(1); 6.2.4.3.(1) to (3)	Existing acceptable.
C90	6.2.4.3.(10)	Where the duct system is being altered, lesser amounts and extent of insulation will be permitted.
C92	6.2.9.2.	Existing acceptable.
C94	6.3.1.	Existing acceptable, provided products of combustion are safely vented.
C176	9.18.3.	Existing vents and ventilation acceptable.
C191	9.32.	In detached houses, semi-detached houses, townhouses and row houses containing not more than two *dwelling units*, rooms or spaces in *dwelling units* to be ventilated by natural means in accordance with Subsection 9.32.2. or by providing adequate mechanical ventilation.
C192	9.33.1.1.	In a *building* containing not more than four *dwelling units*, the existing heating or *air conditioning* system may be altered to serve more than one *dwelling unit* provided *smoke alarms* are installed in each *dwelling unit* and provided a *smoke detector* is installed in the supply or return air duct system serving the entire *building* which would turn off the fuel supply and electrical power to the heating system upon activation of such detectors.
C193	9.33.1.2.	Sound, used or antique *appliances* are acceptable, provided that: (a) visual examination shows no excessive weakening by corrosion or other damage, (b) no structural parts are missing, (c) no cracks are present in the components intended to support the *appliance* or enclose the fire, and (d) loading and ash removal door latches and hinges hold the door closed.
C194	9.33.4.3.(1)	Carbon monoxide detectors may be battery operated or plugged into an electrical outlet.

STOP

EXERCISE #18-3

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. The OBC text for 6.2.4.3.(10) reads as follows:

   (10) Where a *supply* or *return duct* is not protected by an insulated exterior wall or where the duct is exposed to an unheated space it shall be insulated to provide a thermal resistance of not less than RSI 2.1.

   Compliance Alternative C90 in Table 11.5.1.1.C. lists the following alternative:

   Where the duct system is being altered, lesser amounts and extent of insulation will be permitted.

   Which one of the following best describes the intent of the *compliance alternative*?
   - a) solution of a structural problem
   - b) preservation of a *heritage building*
   - c) increase in *performance level*
   - d) solution for an altered *building system*

OBC Reference ____________________________

2. The OBC text for 9.32.1.1.(1) forming part of the requirements of Section 9.32., reads as follows:

   (1) This Section applies to the ventilation of rooms and spaces in *residential occupancies* by natural ventilation and to self-contained mechanical ventilation systems serving only one *dwelling unit*.

   Compliance Alternative C191 in Table 11.5.1.1.C. lists the following alternative:

   In detached houses, semi-detached houses, townhouses and row houses containing not more than two *dwelling units*, rooms or spaces in *dwelling units* to be ventilated by natural means in accordance with Subsection 9.32.2. or by providing adequate mechanical ventilation.

   Which one of the following best describes the intent of the *compliance alternative*?

   a) Relaxing of natural ventilation requirement to include *buildings* with up to two *dwelling units*
   b) Solution to a structural problem
   c) Promote splitting of house into *suites*
   d) Relaxing of mechanical ventilation requirement to include *buildings* with up to two *dwelling units*

OBC Reference ______________________________

3. The OBC text for 9.33.4.3.(1) forming part of the requirements of Section 9.33., reads as follows:
(1) The carbon monoxide detector required by Article 9.33.4.2. shall

(a) be permanently connected to an electrical circuit and shall have no disconnect switch between the overcurrent device and the carbon monoxide detector,

(b) be wired so that its activation will activate all carbon monoxide detectors within the *suite*, where located within a *suite* of *residential occupancy*,

(c) be equipped with an alarm that is audible within bedrooms when the intervening doors are closed, where located adjacent to a sleeping area, and

(d) conform to

(i) CAN/CSA 6.19, "Residential Carbon Monoxide Alarming Devices", or

(ii) UL 2034, "Single and Multiple Station Carbon Monoxide Detectors"

Compliance Alternative C194 in Table 11.5.1.1.C. lists the following alternative:

Carbon monoxide detectors may be battery operated or plugged into an electrical outlet.

Which one of the following best describes the intent of the *compliance alternative*?

a) solution to structural problem
b) solution for safe/practical addition of *building system* (no new electrical circuits required)
c) limit electrical loads for existing *building*
d) provide immediate detector coverage

OBC Reference ________________________________

STOP

COMPLIANCE ALTERNATIVES DE4, DE9, DE17, DE20-DE24, DE34, DE43, DE60, DE62, DE66, DE78-DE82, DE150, DE165

F4, F9, F19, F22-F26, F36, F45, F62, F64, F68, F79-F84, F149, F164

Selecting DE22 as an example for *compliance alternative*; reference Article **3.2.5.13 Automatic Sprinkler Systems,** of **Section 3.2 Building Fire Safety**. The Part 3 requirement is as follows:

- - - - - - - - - - - - - - - *start of OBC text* - - - - - - - - - - - - - - - - -

3.2.5.13. Automatic Sprinkler Systems

(1) Except as permitted by Sentences (2), (3) and (4), an automatic sprinkler system shall be designed, constructed, installed and tested in conformance with NFPA 13, "Standard for the Installation of Sprinkler Systems".

- - - - - - - - - - - - - - - - *end of OBC text* - - - - - - - - - - - - - - - -

Article 3.2.5.13. sets out the OBC requirements for automatic sprinkler systems. In the case of an existing *building* of *business* or *mercantile occupancy* with proposed alterations to *building systems* the *compliance alternative* DE22 revises the Part 3 requirement as worded

- - - - - - - - - - - - - - - *start of OBC text* - - - - - - - - - - - - - - - - -

DE22 – Existing sprinkler systems in existing *buildings* that do not conform to NFPA 13 may be altered, added to, or extended from the existing system without complying with NFPA 13, provided the system is operational and adequate with respect to coverage, water supply and controls, and provided the system is evaluated by a qualified designer.

- - - - - - - - - - - - - - - - *end of OBC text* - - - - - - - - - - - - - - - -

This *compliance alternative* takes into account the functionality of the existing sprinkler system equipment and sets an operational/adequate and verification by a qualified designer requirement.

Note that the identically worded *compliance alternative* occurs as A22, B25, C24, and F24 in Tables 11.5.1.1.A., 11.5.1.1.B., 11.5.1.1.C., and 11.5.1.1.F. correspondingly.

The following portions of Table 11.5.1.1.D/E. and Table 11.5.1.1.F contain the remainder of the *compliance alternatives* directly related to the scope of the Building Services course.

TABLE 11.5.1.1.D/E.
Compliance Alternatives for Business/Mercantile Occupancies
Forming Part of Article 11.5.1.1.

TABLE 18-4

NUMBER	PART 3 - REQUIREMENTS	PART 11 - COMPLIANCE ALTERNATIVE
DE4	3.1.5.15.; 3.1.5.16.; 3.1.5.17.; 3.1.5.21.; 3.1.4.23.	Existing acceptable.
DE9	3.1.8.7.; 3.1.8.9.	*Fire dampers* or *fire stop flaps* are not required to be installed in existing ducts at penetrations of existing *fire separations*.
DE17	3.2.4.	(a) Existing fire alarm system may remain except that Article 3.2.4.5. does not apply where the "Fire Safety Plan" (as described in Subsection 2.8.2. of the Ontario Fire Code) for the *building* addresses the intent of Subsection 3.2.4. (i.e. "stage" system, electrical supervision, detection as required, Fire Department connection, and emergency power supply), and (b) Extension of an existing system must ensure continuity and compatibility, and integrity of the system.
DE20	3.2.5.4.; 3.2.5.5.; 3.2.5.6.	Existing acceptable provided the building is sprinklered.
DE21	3.2.5.7.	Does not apply, except where a change in *major occupancy* occurs from a lesser *hazard index*.
DE22	3.2.5.13.	Existing sprinkler systems in existing *buildings* that do not conform to NFPA 13 may be altered, added to, or extended from the existing system without complying with NFPA 13, provided the system is operational and adequate with respect to coverage, water supply and controls, and provided the system is evaluated by a qualified designer.
DE23	3.2.6.	Reserved
DE24	3.2.9.	Does not apply to *buildings 6 storeys* and less. Does not apply to *sprinklered buildings*.
DE34	3.3.5.4.; 3.3.5.7.(3)	Need not comply where a gasketed door and self closer are provided in the existing *fire separation*.
DE43	3.4.5.1.(2) and (7)	Existing illuminated legible *exit* signs are acceptable.

NUMBER	PART 6 - REQUIREMENTS	PART 11 - COMPLIANCE ALTERNATIVE
DE60	3.6.2.2.	Existing acceptable where explosion-resistant *construction* or venting is provided.
DE62	3.6.2.8.(1)	2 h *fire separation* acceptable.
DE66	3.6.4.3.(1)	Existing to meet *flame-spread rating* of 25 or to be *sprinklered*.
DE78	6.2.3.2.; 6.2.3.9.; 6.2.3.18.; 6.2.3.19.	Existing acceptable.
DE79	6.2.3.13.	Existing openings, grilles and diffusers acceptable, subject to approval of *chief building official*.
DE80	6.2.4.2.(1); 6.2.4.3.(1) to (3) and (5)	Existing acceptable.
DE81	6.2.4.3.(10)	Where the duct system is being altered, lesser amounts and extent of insulation will be permitted.
DE82	6.2.9.2.	Existing acceptable.
NUMBER	PART 9 REQUIREMENTS	PART 11 COMPLIANCE ALTERNATIVE
DE150	9.18.3.	Existing vents and ventilation acceptable.
DE165	9.33.1.2.	Sound, used or antique *appliances* are acceptable, provided that: (a) visual examination shows no excessive weakening by corrosion or other damage, (b) no structural parts are missing, (c) no cracks are present in the components intended to support the *appliance* or enclose the fire, and (d) loading and ash removal door latches and hinges hold the door closed.

TABLE 11.5.1.1.F.
Compliance Alternatives for Industrial Occupancies
Forming Part of Article 11.5.1.1.

TABLE 18-5

NUMBER	PART 3 - REQUIREMENTS	PART 11 - COMPLIANCE ALTERNATIVE
F4	3.1.5.15.; 3.1.5.16.; 3.1.5.17.; 3.1.5.21.; 3.1.5.23.	Existing acceptable.
F9	3.1.8.7.; 3.1.8.9.	*Fire dampers* or *fire stop flaps* are not required to be installed in existing ducts at penetrations of existing *fire separations*.
F19	3.2.4.	(a) existing fire alarm system may remain except that Article 3.2.4.5. does not apply where the "Fire Safety Plan" (as described in Subsection 2.8.2. of the Ontario Fire Code) for the *building* addresses the intent of Subsection 3.2.4. (i.e. "stage" system, electrical supervision, detection as required, Fire Department connection, and emergency power supply), and (b) extension of an existing system must ensure continuity and compatibility, and integrity of the system.
F22	3.2.5.4.; 3.2.5.5.;3.2.5.6.	Existing acceptable provided the *building* is *sprinklered*.
F23	3.2.5.7.	Does not apply, except where a change in *major occupancy* occurs from a lesser *hazard index*.
F24	3.2.5.13.	Existing sprinkler systems in existing *buildings* that do not conform to NFPA 13 may be altered, added to, or extended from the existing system without complying with NFPA 13, provided the system is operational and adequate with respect to coverage, water supply and controls, and provided the system is evaluated by a qualified designer.
F25	3.2.6.	Reserved
F26	3.2.9.	May not apply to *buildings* 6 *storeys* and less of "F2" and "F3" occupancies. Does not apply to *sprinklered buildings*.
F36	3.3.5.6.; 3.3.5.7.	Need not comply where a gasketed door and self closer are provided in the existing *fire separation*.
F45	3.4.5.1.(2) and (7)	Existing illuminated legible *exit* signs are acceptable.
F62	3.6.2.2.	Existing acceptable where explosion-resistant *construction* or venting is provided.
F64	3.6.2.8.(1)	2 h *fire separation* acceptable.
F68	3.6.4.3.(1)	Existing to meet *flame-spread rating* of 25 or to be *sprinklered*.
NUMBER	PART 6 REQUIREMENTS	PART 11 COMPLIANCE ALTERNATIVE

NUMBER	PART 6 - REQUIREMENTS	PART 11 - COMPLIANCE ALTERNATIVE
F79	6.2.2.3.(1), (3), and (4)	*Storage garages* with a total capacity of less than 20 motor vehicles need not have mechanical ventilating systems if the downward slope of the floor to the outside door is 1 in 120 and the garage floor is above outside ground level.
F80	6.2.3.2.; 6.2.3.9.; 6.2.3.18.; 6.2.3.19.	Existing acceptable for "F2" and "F3" *occupancies*.
F81	6.2.3.13.	Existing openings, grilles and diffusers acceptable.
F82	6.2.4.2.(1); 6.2.4.5.(1) to (3) and (5)	Existing acceptable.
F83	6.2.4.3.(10)	Where the duct system is being altered, lesser amounts and extent of insulation will be permitted.
F84	6.2.9.2.	Existing acceptable for "F2" and "F3" *occupancies*.
NUMBER	PART 9 REQUIREMENTS	PART 11 COMPLIANCE ALTERNATIVE
F149	9.18.3.	Existing vents and ventilation acceptable.
F164	9.33.1.2.	Sound, used or antique *appliances* are acceptable, provided that: (a) visual examination shows no excessive weakening by corrosion or other damage, (b) no structural parts are missing, (c) no cracks are present in the components intended to support the *appliance* or enclose the fire, and (d) loading and ash removal door latches and hinges hold the door closed.

EXERCISE #18-4

For each of the following questions review the presented text and use the applicable OBC references to select the correct answer using the multiple-choice method.

1. For an existing business/mercantile occupancy, which one of the following correctly describes the compliance alternative regarding standpipe systems?
a) standpipe system required in buildings over 6 storeys that are not sprinklered;
b) standpipe system required in buildings over 6 storeys;
c) standpipe system required in buildings that are not sprinklered;
d) standpipe system required in buildings under 7 storeys that are not sprinklered.

OBC Reference ________________________________

2. For an exiting storage garage with a total capacity of 18 motor vehicles and a garage floor above outside ground level, which one of the following design conditions qualifies the building for a compliance alternative canceling the requirement for mechanical ventilation?
a) at least two sides of the building are open-air style construction;
b) the building is sprinklered;
c) the slope of the floor to the door is 1 in 120;
d) there is no other occupancy in the building.

OBC Reference ________________________________

STOP

BUILDING SERVICES
ANSWER GUIDE

Module 1: The OBC and Building Services – Definitions and Scope		
Exercise	Question	Answer and OBC Reference
# 1-1	Example	Answer: Enter Table 1.3.1.2. under column "Issuing Agency" – "ULC" find listing for CAN/ULC-S109, note OBC references under "Code Reference" and search references for connectors in air duct systems. OBC: 6.2.3.18.(1)
# 1-1	# 1	Answer: d OBC: Division A, 1.1.2.2(a)(iii)
# 1-1	# 2	Answer: Enter Table 1.3.1.2. under column "Issuing Agency" – "ULC" find listing for CAN/ULC-S112, note edition reference as: CAN/ULC-S112-M90 OBC: Table 1.3.1.2.
# 1-1	# 3	Answer: b OBC: 12.2.1.1.(4)
# 1-1	# 4	Answer: Refer to Table of Contents for Part 3 Fire Protection Occupant Safety and Accessibility and search for applicable reference to exits – Section 3.4. Exits, search through contents for applicable reference to fire separations – Subsection 3.4.4. Fire Separation of Exits, search for applicable reference to breaching of fire separations – Article 3.4.4.4. Integrity of Exits. OBC: 3.4.4.4.
# 1-2	Example	Answer: b OBC: Division A, 1.4.1.2.
# 1-2	# 1	Answer: a OBC: Division A, 1.4.1.2.
# 1-2	# 2	Answer: c OBC: Division A, 1.4.1.2.
# 1-3	Example	Answer: c OBC: Division A, 1.4.1.2.
# 1-3	# 1	Answer: c OBC: Division A, 1.4.1.2.
# 1-3	# 2	Answer: b OBC: Division A, 1.4.1.2.

Module 2: Energy Efficiency		
Exercise	Question	Answer and OBC Reference
# 2-1	Example	Answer: To clarify and modify requirements to ensure compatibility with Canadian climate and construction practices; to increase 90.1 envelope requirements and bring mNEC to a new higher performance level OBC: SB-10 page 2

# 2-1	# 1	Answer: The exemption applies where the environmental condition within the building is governed by the operation or process within the building OBC: SB-10, 1.2.1.1
# 2-1	# 2	Answer: d OBC: 12.2.1.1; SB-10, 1.2.1.1
# 2-2	Example	Answer: 2.29 OBC: SB-10, Table 9.1.5.1.
# 2-2	# 1	Answer: c OBC: 6.4.1.4 outlines requirements of verification of equipment efficiency. Table 6.8.1G outlines performance requirements of cooling towers.
# 2-2	# 2	Answer: c OBC: SB-10, 7.4.5.2

Module 3: Services in Combustible and Noncombustible Construction

Exercise	Question	Answer and OBC Reference
# 3-1	Example	Answer: Permitted if not more than 3 m in length from point of entering building or leaving required protection. OBC: 3.1.4.3.(3)(a)
# 3-1	# 1	Answer: c OBC: 3.1.4.3.(1)(b)
# 3-1	# 2	Answer: a OBC: 6.2.1.12.(1)
# 3-1	# 3	Answer: d OBC: 3.1.5.15.(3)
# 3-2	Example	Answer: Comply with FT4 or FT6 Rating OBC: 3.1.5.21.(2)
# 3-2	# 1	Answer: Not more than 175 mm in outside diameter and Section 3.4 of ULC/ORD-C2024. OBC: 3.1.5.20.(1)
# 3-2	# 2	Answer: b OBC: 3.1.5.19.(1)

Module 4: Openings and Fire Dampers

Exercise	Question	Answer and OBC Reference
# 4-1	Example	Answer: compartment either side not sprinklered, 11 m2, no dimension more than 3.7 m compartment both sides sprinklered 11 m2, no dimension more than 6.0 m OBC: 3.1.8.6.(1) and (2)
# 4-1	# 1	Answer: a fusible link conforming to ULC-S505, or other heat-actuated or smoke-actuated device. OBC: 3.1.8.9.(1)
# 4-1	# 2	Answer: c OBC: 3.1.8.10.(1)(a)

# 4-1	# 3	Answer: to stay in place should the duct be dislodged during a fire OBC: 3.1.8.9.(3)
# 4-2	Example	Answer: noncombustible with melting point above 760oC, discharge less than 1200 above floor, and cross-sectional area not more than 0.013 m2 OBC: 3.1.8.8.(1)
# 4-2	# 1	Answer: continuous noncombustible duct with no lower limit to melting point, allowed to cross vertical or horizontal fire separations OBC: 3.1.8.8.(2) and (3)
# 4-2	# 2	Answer: b OBC: 3.1.8.8.(7)

Module 5: Building Services in Fire Separations and Fire Rated Assemblies		
Exercise	Question	Answer and OBC Reference
# 5-1	Example	Answer: concrete cover is not less than 50 mm, not required to incorporate at time of test OBC: 3.1.9.3.(4)
# 5-1	# 1	Answer: differential test at 50 Pa and not located in a vertical shaft OBC: 3.1.9.4.(4)
# 5-1	# 2	Answer: b OBC: 3.1.9.3.(3)
# 5-1	# 3	Answer: box is not more than 0.016 m2, and to be offset to maintain integrity of fire separation. OBC: 3.1.9.3.(5) and (6)

Module 6: Fire Alarm and Detection Systems		
Exercise	Question	Answer and OBC Reference
# 6-1	Example	Answer: b OBC: 3.2.4.1.(2)(f)
# 6-1	# 1	Answer: d OBC: 3.2.4.1.(4)
# 6-1	# 2	Answer: b OBC: 3.2.4.1(2).(h)
# 6-1	# 3	Answer: b OBC: 3.2.4.2.(5)
# 6-1	# 4	Answer: a OBC: 3.2.4.1.(5)
# 6-2	Example	Answer: c OBC: 3.2.4.4.(c)
# 6-2	# 1	Answer: b OBC: 3.2.4.3.(1)(a)
# 6-2	# 2	Answer: c OBC: Division A, 1.4.1.2.(1)(b)
# 6-2	# 3	Answer: d OBC: 3.2.4.4.(3)(a)
# 6-2	# 4	Answer: c OBC: 3.2.4.9.(2)

# 6-3	Example	Answer: d OBC: 3.2.4.15.
# 6-3	# 1	Answer: a OBC: 3.2.4.11.(1)(e)
# 6-3	# 2	Answer: d OBC: 3.2.4.17.(1)
# 6-3	# 3	Answer: b OBC: 3.2.4.21.(1)
# 6-3	# 4	Answer: b OBC: 3.2.4.21.(5)
# 6-4	Example	Answer: d OBC: 3.2.4.8.(2)(b)
# 6-4	# 1	Answer: c OBC: 3.2.4.8.(7)
# 6-4	# 2	Answer: c OBC: 3.2.4.6.(3)
# 6-4	# 3	Answer: a OBC: 3.2.4.7.(1)(c)
# 6-4	# 4	Answer: d OBC: 3.2.4.14.(3)
# 6-5	Example	Answer: c OBC: 3.2.4.19.(6)
# 6-5	# 1	Answer: c OBC: 3.2.4.18.(3)(c)
# 6-5	# 2	Answer: c OBC: 3.2.4.19.(10)
# 6-5	# 3	Answer: d OBC: 3.2.4.22.(3)(b)
# 6-5	# 4	Answer: b OBC: 3.2.4.22.(4)

Module 7: Provisions for Fire Fighting		
Exercise	Question	Answer and OBC Reference
# 7-1	Example	Answer: locate adjacent to hydrants, total distance not more than 90 m, of which vehicle to building is not more than 45 m OBC: 3.2.5.5.(2)
# 7-1	# 1	Answer: locate adjacent to hydrants, total distance not more than 90 m, of which vehicle to building is not more than 45 m OBC: 3.2.5.5.(2)
# 7-1	# 2	Answer: b OBC: 3.2.5.5.(4)
# 7-1	# 3	Answer: search for fire pump requirements, find 3.2.5.19, standard is NFPA 20, refer to Part 1 Table 1.3.1.2 OBC: 3.2.5.19; 1.3.1.2
# 7-1	# 4	Answer: c OBC: 3.2.5.5.(1)
# 7-2	Example	Answer: NFPA 13R allowed for residential occupancy not more than 4 storeys, or B3 with sleeping accommodation for less than 10 and not more than 6 requiring evacuation assistance; NFPA 13D allowed for building of residential occupancy containing not more that 2 dwelling units and system with fewer than 9 sprinkler heads may be supplied from domestic system OBC: 3.2.5.13. (2-4)

# 7-2	# 1	Answer: standpipe riser not less that 6 in diam, hydraulically designed combined water supply, water supply to be increased by a minimum of 570 L/min, water detection on branch from riser, separate indication on fire alarm annunciator. OBC: 3.2.5.15.(5)
# 7-2	# 2	Answer: a OBC: 3.2.5.14.(3)
# 7-2	# 3	Answer: cables and wires meet 3.1.5.21., noncombustible construction, is used for A/C – smoke detector required, easy access, more that 2 000 m2, smoke detectors required to be zoned for every 2 000 m2 OBC: 3.2.5.15.(4)
# 7-2	# 4	Answer: d OBC: 3.2.5.13.(5)

Module 8: Additional (Fire Fighting) Requirements for High Buildings		
Exercise	**Question**	**Answer and OBC Reference**
# 8-1	Example	Answer: Major occupancy: D and E, therefore OBC Clause 3.2.6.1.(1)(a) applies. Building height: 6 storeys x 4 m/storey = 24 m to the floor level of the top storey, therefore OBC Subclause 3.2.6.1.(1)(a)(ii) applies. Cumulative occupant load: (2 x 450) + (4 x 200) = 1 700 persons above the first storey. Total exit width: 3 exits x 1.4 m = 4.2 m Occupant load/exit width factor: 1 700/(1.8 x 4.2) = 225 The occupant load/exit width factor is less than 300 therefore the building is NOT a high building.

# 8-1	# 1	3.2.6.2.(2) Answers: • not applicable to sprinklered buildings complying with OBC Reference: 3.2.6.4.(1)(a) through (d); • not applicable to Group C buildings with areas of refuge for above grade storeys OBC Reference: 3.2.6.3; • not applicable to Group C buildings not more than 75 m high and satisfying the following formula: O.L. above grade < exit area (m2) x 3.6 OBC Reference: 3.2.6.5; • not applicable to Group C buildings complying with OBC Reference: 3.2.6.6.(1)(a) through (d); • not applicable to Group C apartment buildings OBC Reference: 3.2.6.6.(2). 3.2.6.2.(3)(a) Answers: • not applicable to sprinklered buildings complying with OBC Reference: 3.2.6.4.(1)(a) through (d); • not applicable to Group C buildings complying with OBC Reference: 3.2.6.6.(1)(a) through (d); • not applicable to Group C apartment buildings OBC Reference: 3.2.6.6.(2); 3.2.6.2.(3)(b) Answers: • not applicable to Group C apartment buildings OBC Reference: 3.2.6.6.(2); 3.2.6.2.(4) Answers: • not applicable to sprinklered buildings complying with OBC Reference: 3.2.6.4.(1)(a) through (d); • not applicable to Group C buildings complying with OBC Reference: 3.2.6.6.(1)(a) through (d);
# 8-1	# 2.a	Answer: 14 x 3.5 = 49 m > 36 m, therefore high building OBC: 3.2.6.1.(1)(a)(i)
# 8-1	# 2.b	Answer: B occupancy above the 3rd storey, therefore high building OBC: 3.2.6.1.(1)(b)
# 8-1	# 2.c	Answer: 5 x 3.4 = 17 m < 18 m, therefore not a high building OBC: 3.2.6.1.(1)(d)
# 8-1	# 3	Answer: Cold temperatures result in large differences between indoor and outdoor temperatures, thereby accentuating stack effect and creating conditions for substantial smoke spread.

# 8-1	# 4	Answer: 14 x 3.5 = 49 m < 75 m, therefore 3.2.6.5. may apply. 18.5 m2 x 3.6 = 66.6 m2 > 62 person occupant load. The building satisfies the requirements of [3.2.6.5.] for waiver of compliance with [3.2.6.2.(2)].
# 8-2	# 1.a	Answer: not more than 75 m high OBC: 3.2.6.3.(2)
# 8-2	# 1.b	Answer: more than 75 m high OBC: 3.2.6.3.(3)
# 8-2	# 2.a	Answer: Yes (serves more than 2 storeys) OBC: 3.2.6.2.(5)
# 8-2	# 2.b	Answer: No (serves only 1 storey) OBC: 3.2.6.2.(5)
# 8-2	# 2.c	Answer: No (serves only 2 storeys) OBC: 3.2.6.2.(5)
# 8-2	# 2.d	Answer: Yes, more than two storeys served. Note that the answer would be 'No' if the bathroom exhaust fans were individual to each dwelling unit OBC: 3.2.6.6.(d)
# 8-3	# 1.a	Answer: must be located where breakage will not endanger pedestrians below OBC: 3.2.6.10.(3)
# 8-3	# 1.b	Answer: must be permanently marked to be easily identified OBC: 3.2.6.10.(4)
# 8-3	# 2.a	Answer: elevator lobby at recall level OBC: 3.2.6.8.(2)(a)
# 8-3	# 2.b	Answer: central alarm and control facility OBC: 3.2.6.8.(2)(b)
# 8-3	# 3	Answer: requires emergency recall only if the elevator serves storeys above the first storey OBC: 3.2.6.4.(1)
# 8-4	# 1	Answer: requires emergency recall only if the elevator serves storeys above the first storey OBC: 3.2.6.8.(1, 5)
# 8-4	# 2	Answer and OBC: 3.2.4.22.(4)
# 8-4	# 3	Answer and OBC: 1 X X 3.2.6.12.(2)(b) 2 X 3.2.6.12.(2)(c) 3 X 3.2.6.12.(2)(k) 4 X X 3.2.6.12.(2)(l) 5 X 3.2.6.7.(2)(m)

Module 9: Lighting and Emergency Power Systems		
Exercise	Question	Answer and OBC Reference
# 9-1	Example	Answer: 500 and 300 lx at floor level OBC: 3.2.7.1.(6) & (7)
# 9-1	# 1	Answer: 2 h for 3.2.6 building, 1 h Group B (not 3.2.6.), 30 min all other OBC: 3.2.7.4.(1)(b)
# 9-1	# 2	Answer: a OBC: 3.2.7.3.(3)
# 9-1	# 3	Answer: it will assume the electrical load automatically OBC: 3.2.7.4.(1)(b)
# 9-1	# 4	Answer: b OBC: Table 9.34.2.7.
# 9-2	Example	Answer: CSA-Z32, "Electrical Safety and Essential Electrical Systems for Health Care Facilities", 2004 OBC: Table 21.3.1.2.
# 9-2	# 1	Answer: separate service space with minimum 45 min rating OBC: 3.2.7.7.(2)
# 9-2	# 2	Answer: b OBC: 3.2.7.8.(3)(a)
# 9-2	# 3	Answer: does not apply if the time to recall all elevators under emergency power supply is not more than 5 min OBC: 3.2.7.9.(3)
# 9-2	# 4	Answer: c OBC: 3.2.7.8.(3)

Module 10: Mezzanines and Opening through Floor Assemblies		
Exercise	Question	Answer and OBC Reference
# 10-1	Example	Answer: 2h, 1%, and January 2.5% OBC: 3.2.8.4.(1)
# 10-1	# 1	Answer: restrict passage of smoke OBC: 3.2.8.6.(1)(a)
# 10-1	# 2	Answer: a OBC: 3.2.8.4.(2)
# 10-2	Example	Answer: exceeds 17,000m3 then only 4 air change per hour. 17,000m3 or under then 6 ACH OBC: 3.2.8.9.(6)
# 10-2	# 1	Answer: no response, 2 smoke detectors in a single zone will cause a shutdown OBC: 3.2.8.9.(3)
# 10-2	# 2	Answer: d OBC: 3.2.8.9.(8)
# 10-3	Example	Answer: more than 18 m then 2 h power for smoke control fans OBC: 3.2.8.10.(1)

# 10-3	# 1	Answer: storeys that are wholly of partially within an IFS and all storeys below the IFS are to be sprinklered OBC: 3.2.8.7.(1)
# 10-3	# 2	Answer: b OBC: 3.2.8.8.(c)

Module 11: Standpipe Systems

Exercise	Question	Answer and OBC Reference
# 11-1	Example	Answer: b OBC: 3.2.9.1.(6)
# 11-1	# 1	Answer: c OBC: Table 3.2.9.1
# 11-1	# 2	Answer: b OBC: 3.2.9.1.(5)
# 11-1	# 3	Answer: a OBC: 3.2.9.1.(1)(c)
# 11-1	# 4	Answer: c OBC: Table 3.2.9.1.
# 11-2	Example	Answer: d OBC: 3.2.9.2.(8)
# 11-2	# 1	Answer: a OBC: 3.2.9.2.(4)(a)
# 11-2	# 2	Answer: b OBC: 3.2.9.2.(9)
# 11-2	# 3	Answer: b OBC: 3.2.9.5.(1)
# 11-3	Example	Answer: a OBC: 3.2.9.4.(4)
# 11-3	# 1	Answer: b OBC: 3.2.9.3.(2)(b)
# 11-3	# 2	Answer: c OBC: 3.2.9.4.(5)(a)
# 11-3	# 3	Answer: d OBC: 3.2.9.4.(8)
# 11-3	# 4	Answer: c OBC: 3.2.9.4.(10)(a
# 11-4	Example	Answer: b OBC: 3.2.9.7.(3)
# 11-4	# 1	Answer: d OBC: 3.2.9.5.(1)
# 11-4	# 2	Answer: b OBC: 3.2.9.6.(1) 3.2.9.7.(1)
# 11-4	# 3	Answer: c OBC: 3.2.9.7.(4)
# 11-4	# 4	Answer: a OBC: 3.2.9.7.(1)(a)

Module 12: Safety and Accessibility within Floor Areas

Exercise	Question	Answer and OBC Reference
# 12-1	Example	Answer: c OBC: 3.3.1.2.(3)
# 12-1	# 1	Answer: d OBC: 3.3.1.2.(2)
# 12-1	# 2	Answer: a OBC: 3.3.1.7.(1)(a)(iii)
# 12-1	# 3	Answer: d OBC: 3.8.1.5.(1)
# 12-1	# 4	Answer: c OBC: 3.4.5.1.(8)
# 12-2	Example	Answer: d OBC: 3.3.2.12.(5)
# 12-2	# 1	Answer: b OBC: 3.3.2.4.(14)(g)

# 12-2	# 2	Answer: c OBC: 3.3.3.7.(4)
# 12-2	# 3	Answer: c OBC: 3.3.5.7.(3)(b)(ii)
# 12-3	Example	Answer: a OBC: 3.6.2.2.(1)
# 12-3	# 1	Answer: c OBC: 3.6.2.7.(9)
# 12-3	# 2	Answer: d OBC: 3.6.2.7.(12)(d)
# 12-3	# 3	Answer: a OBC: 3.6.4.3.(1)(a)

Module 13: Portable Classrooms and Self-Service Storage Buildings

Exercise	Question	Answer and OBC Reference
# 13-1	Example	Answer: a OBC: 3.9.3.7.(4)(b)
# 13-1	# 1	Answer: d
# 13-1	# 2	Answer: c OBC: 3.9.3.7.(2)(a)
# 13-1	# 3	Answer: d OBC: 3.10.3.4.(2) / (3)

Module 14: Public Pools and Spas

Exercise	Question	Answer and OBC Reference
# 14-1	Example	Answer: b OBC: 3.11.3.1.(17)
# 14-1	# 1	Answer: a OBC: 3.11.8.1.(5)(c)
# 14-1	# 2	Answer: d OBC: 3.11.8.1.(8)(b)
# 14-1	# 3	Answer: c OBC: 3.11.8.1.(19)
# 14-1	# 4	Answer: d OBC: 3.11.8.1.(11)
# 14-2	Example	Answer: c OBC: 3.11.10.1.(3)
# 14-2	# 1	Answer: b OBC: 3.11.10.1.(7)
# 14-2	# 2	Answer: b OBC: 3.11.10.1.(12)/(13)
# 14-2	# 3	Answer: b OBC: 3.11.11.1.(2)(f)
# 14-3	Example	Answer: d OBC: 3.11A.1.1.(5)
# 14-3	# 1	Answer: c OBC: 3.12.4.1.(2)(b)
# 14-3	# 2	Answer: b OBC: 3.12.4.1.(11)
# 14-3	# 3	Answer: d OBC: OBC: 3.12.4.1.(17)

Module 15: Rapid Transit and Air Supported Structures

Exercise	Question	Answer and OBC Reference
# 15-1	Example	Answer: c OBC: 3.13.5.2.(1)
# 15-1	# 1	Answer: b OBC: 3.13.5.10.(2)
# 15-1	# 2	Answer: c OBC: 3.14.2.6.(1)
# 15-1	# 3	Answer: d OBC: 3.13.5.11.(5) / (6)

Module 16: Heating, Ventilating and Air-Conditioning		
Exercise	Question	Answer and OBC Reference
# 16-1	Example	Answer: a Enter Table 1.2 horizontally at Alliston and vertically under Design Temperature January 2.5 % oC. Where the horizontal entry intersects with vertical entry – retrieve data.
# 16-1	# 1	Answer: a OBC: SB-1, p. 10
# 16-1	# 2	Answer: c OBC: 6.2.1.2.(2)
# 16-1	# 3	Answer: a OBC: 6.2.1.7.(1)→ SB-1
# 16-1	# 4	Answer: c OBC: 6.2.1.1.(1)(d); Table 1.3.1.2
# 16-2	Example	Answer: b OBC: 6.2.1.4.(3)
# 16-2	# 1	Answer: c OBC: 6.2.1.4.(1)
# 16-2	# 2	Answer: b OBC: 6.2.1.5.(1)
# 16-2	# 3	Answer: a OBC: 6.2.1.6.(2)(a)
# 16-2	# 4	Answer: b OBC: 6.2.1.4.(3)(b)
# 16-3	Example	Answer: c OBC: 6.2.1.9.(1)
# 16-3	# 1	Answer: b OBC: 6.2.1.10.(1)
# 16-3	# 2	Answer: c OBC: 6.2.1.8.(1)
# 16-3	# 3	Answer: d OBC: 6.2.1.12.(1)
# 16-4	Example	Answer: c OBC: 6.2.2.1.(3)
# 16-4	# 1	Answer: d OBC: 6.2.2.1.(2)
# 16-4	# 2	Answer: b OBC: 6.2.2.2.(1)(a)
# 16-4	# 3	Answer: d OBC: 6.2.2.4.(1)
# 16-4	# 4	Answer: c OBC: 6.2.2.4.(4)
# 16-5	Example	Answer: b OBC: 6.2.2.3.(1)(c)
# 16-5	# 1	Answer: c OBC: 6.2.2.3.(1)(a)
# 16-5	# 2	Answer: d OBC: 6.2.2.5.(1)
# 16-5	# 3	Answer: b OBC: 6.2.2.6.(1)
# 16-5	# 4	Answer: c OBC: 6.2.2.3.(10)
# 16-6	Example	Answer: b OBC: 6.2.3.3.(2)
# 16-6	# 1	Answer: a OBC: 6.2.3.8.(6)(a)
# 16-6	# 2	Answer: b OBC: 6.2.3.8.(16)
# 16-6	# 3	Answer: b OBC: 6.2.3.4.(6)
# 16-7	Example	Answer: a OBC: 6.2.3.18.(9)
# 16-7	# 1	Answer: d OBC: 6.2.3.9.(1)

# 16-7	# 2	Answer: d OBC: 3.2.3.20.(3)
# 16-7	# 3	Answer: b OBC: 6.2.3.15.(2)
# 16-7	# 4	Answer: c OBC: 6.2.3.14.(3)
# 16-8	Example	Answer: d OBC: 6.2.4.3.(2)
# 16-8	# 1	Answer: c OBC: 6.2.3.2.(5)
# 16-8	# 2	Answer: c OBC: 6.2.4.2
# 16-8	# 3	Answer: b OBC: 6.2.4.4.(6)
# 16-8	# 4	Answer: c OBC: 6.2.4.7.(5)
# 16-9	Example	Answer: c OBC: 6.2.4.10. and also Inferred that dimension is set by other agency, CGA, ULC, etc.
# 16-9	# 1	Answer: d OBC: 6.2.4.10.(3)
# 16-9	# 2	Answer: a OBC: 6.2.3.14.(3)(b)
# 16-9	# 3	Answer: c OBC: 6.2.12.2.(1)
# 16-9	# 4	Answer: c OBC: 6.2.12.3.(1)(d)(i)
# 16-10	Example	Answer: c OBC: 6.2.10.
# 16-10	# 1	Answer: d OBC: 6.2.9.2.(3)
# 16-10	# 2	Answer: a OBC: 6.2.11.2.(1)
# 16-10	# 3	Answer: c OBC: 6.3.1.1
# 16-10	# 4	Answer: b OBC: 6.3.1.5.(2)

Module 17: Heating, Ventilating and Air-Conditioning for Housing and Small Buildings

Exercise	Question	Answer and OBC Reference
# 17-1	Example	Answer: c OBC: 9.32.1.1.(1)
# 17-1	# 1	Answer: a OBC: Table 9.32.2.1
# 17-1	# 2	Answer: c OBC: 9.32.1.3.(3)
# 17-1	# 3	Answer: d OBC: 9.32.1.3.(3)
# 17-2	Example	Answer: d OBC: 9.32.3.1.(1)(b)
# 17-2	# 1	Answer: d OBC: 9.32.3.1.(2)(a)(i)
# 17-2	# 2	Answer: b OBC: 9.32.3.2.(1)(b)
# 17-2	# 3	Answer: b OBC: Table 9.32.3.3
# 17-2	# 4	Answer: b OBC: Table 9.32.3.3. note 4
# 17-3	Example	Answer: c OBC: Table 9.32.3.4.A
# 17-3	# 1	Answer: b OBC: 9.32.3.4.(3)
# 17-3	# 2	Answer: d OBC: 9.32.3.4.(7)(b)

# 17-3	# 3	Answer: a OBC: Table 9.32.3.4.B
# 17-3	# 4	Answer: c OBC: Table 9.32.3.4.B and 9.32.3.4.(10)(b)
# 17-4	Example	Answer: b OBC: 9.32.3.5.(1); Table 9.32.3.4.A
# 17-4	# 1	Answer: c OBC: 9.32.3.5.(2)
# 17-4	# 2	Answer: d OBC: 9.32.3.5.(4)(b)
# 17-4	# 3	Answer: c OBC: Table 9.32.3.5. note 1
# 17-4	# 4	Answer: d OBC: 9.32.3.5.(7)
# 17-4	# 5	Answer: a OBC: 9.32.3.5.(6)
# 17-5	Example	Answer: d OBC: 9.32.3.6.
# 17-5	# 1	Answer: b OBC: 9.32.3.7.(4)
# 17-5	# 2	Answer: b OBC: Table 9.32.3.7.A
# 17-5	# 3	Answer: a OBC: 9.32.3.7.(7)(a)
# 17-5	# 4	Answer: c OBC: 9.32.3.7.(10)
# 17-6	Example	Answer: c OBC: 9.32.3.8.(6)
# 17-6	# 1	Answer: c OBC: 9.32.3.9.(3)
# 17-6	# 2	Answer: c OBC: 9.32.3.10.(2)
# 17-6	# 3	Answer: a OBC: 9.32.3.10.(4)
# 17-6	# 4	Answer: c OBC: Table 9.32.3.10.B
# 17-7	Example	Answer: d OBC: 9.32.3.11.(3)
# 17-7	# 1	Answer: d OBC: 9.32.3.11.(9)
# 17-7	# 2	Answer: c OBC: 9.32.3.12.(4)
# 17-7	# 3	Answer: c OBC: 9.32.3.12.(12)
# 17-7	# 4	Answer: b OBC: 9.32.2.13.(2)
# 17-8	Example	Answer: b OBC: 9.33.1.1.(3)
# 17-8	# 1	Answer: d OBC: 9.36.2.1.(4)
# 17-8	# 2	Answer: a OBC: 9.33.3.2; Table 1.2, SB-1
# 17-8	# 3	Answer: b OBC: 9.33.1.2
# 17-8	# 4	Answer: c OBC: Table 1.2, SB-1
# 17-9	Example	Answer: c OBC: 9.33.4.2.(2)
# 17-9	# 1	Answer: c OBC: 9.33.4.3.(1)(a)
# 17-9	# 2	Answer: c OBC: 9.33.4.2.(4)
# 17-9	# 3	Answer: b OBC: 9.33.4.3.(1)(b)
# 17-9	# 4	Answer: d OBC: 9.33.4.1.(1)

Module 18: Renovations		
Exercise	Question	Answer and OBC Reference
# 18-1	Example	Answer: c OBC: 11.3.1.1
# 18-1	# 1	Answer: a OBC: 11.3.3.1.(2)
# 18-1	# 2	Answer: c OBC: 1.4.1.2., compliance alternative definition
# 18-1	# 3	Answer: a OBC: 11.3.1
# 18-2	# 1	Answer: c OBC: Part 11 – A55
# 18-2	# 2	Answer: b OBC: Part 11 – B25
# 18-3	# 1	Answer: d
# 18-3	# 2	Answer: d
# 18-3	# 3	Answer: b
# 18-4	# 1	Answer: a OBC: Part 11 – DE24
# 18-4	# 2	Answer: c OBC: Part 11 – F72

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